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the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1995. The public sector has become a major employer in the UK, and its growth has been a major factor in the overall growth of the economy.

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A

BRIEF COURSE

IN

ARITHMETIC,

*ORAL AND WRITTEN.*

ON THE BASIS OF WORKS

By BENJAMIN GREENLEAF, A.M.



LEACH, SHEWELL, AND SANBORN.

BOSTON. NEW YORK. CHICAGO.

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## PREFACE.



THIS BRIEF COURSE IN ARITHMETIC has been prepared to meet the needs of two classes of learners.

Young pupils who are expected to finish a course of grammar-school study, and who are to be trained in the lower grades to facility and accuracy in the fundamental use of numbers, require training in both oral and written work. While they are not mature enough to comprehend the *theory* and *science* of numbers, they may be especially benefited by much simple *practice*. For them the book furnishes what is desirable, much practical work and little theory.

There are many learners whose circumstances compel them to leave school at an early age. They have little time to spend on definitions and theory, but need practice in the essentials of arithmetic. This work will help such to acquire the ability to use numbers and apply them to the ordinary transactions of life.

The close and constant union of oral and written work, the treatment of decimals, United States money, and denominate numbers in connection with the fundamental rules, and the large number of exercises provided, are among the features that will commend this book to practical teachers.

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# A BRIEF COURSE IN ARITHMETIC.

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## NOTATION AND NUMERATION.

**1.** A **Unit** is a single thing, or one; as one book, one slate.

**2.** A **Number** is a unit, or a collection of units; as one book, five slates.

**3.** **Arithmetic** treats of numbers and their use.

**4.** **Figures** are characters used to express numbers.

**5.** Ten different figures are used in writing numbers :

Name.	Zero,	One,	Two,	Three,	Four,	Five,	Six,	Seven,	Eight,	Nine.
Figure.	0,	1,	2,	3,	4,	5,	6,	7,	8,	9.

These figures used alone express the number of units shown by their names.

The zero, or cipher, used alone expresses *no* units.

**6.** To express numbers larger than nine two or more figures are written side by side.

7. A figure used *alone* has only a *simple name* and *value*; but, when used with other figures, it has also a *place-name* and *value*.

8. When *two* figures are used to express a number, the figure in the first, or right-hand, place has the place-name *ones*, and the figure in the second place has the place-name *tens*. Thus,

10 is 1 ten, 0 ones, or ten.

23 is 2 tens, 3 ones, or twenty-three.

46 is 4 tens, 6 ones, or forty-six.

99 is 9 tens, 9 ones, or ninety-nine.

10 *ones* make 1 *ten*.

9. When *three* figures are used to express a number, the figure in the third, or left-hand, place has the place-name *hundreds*; the figure in the second place, *tens*; and that in the first, *ones*. Thus,

100 is 1 hundred, 0 tens, 0 ones, or one hundred.

280 is 2 hundreds, 8 tens, 0 ones, or two hundred eighty.

672 is 6 hundreds, 7 tens, 2 ones, or six hundred seventy-two.

948 is 9 hundreds, 4 tens, 8 ones, or nine hundred forty-eight.

10 *tens* make 1 *hundred*.

10. When *four* figures are used to express a number, the place-name of the fourth, or left-hand, figure is *thousands*, the place-names of the other three figures being *hundreds*, *tens*, *ones*, as before. Thus,

1000 is 1 thousand, 0 hundred, 0 tens, 0 ones, or one thousand.

2300 is 2 thousand, 3 hundred, 0 tens, 0 ones, or two thousand three hundred.

4560 is 4 thousand, 5 hundred, 6 tens, 0 ones, or four thousand five hundred sixty.

7895 is 7 thousand, 8 hundred, 9 tens, 5 ones, or seven thousand eight hundred ninety-five.

*10 hundreds make 1 thousand.*

# **11. EXERCISES.**

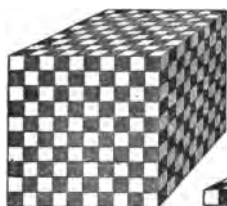
Read the following numbers :

1.	2.	3.	4.	5.	6.
13	68	121	837	1600	8973
25	79	347	608	2705	8888
63	88	829	700	3492	4004
76	45	305	921	6983	9060
89	91	630	346	4217	3498

Write in figures the following numbers :

1. Sixty-four ; eighty-seven ; twenty-two ; ninety.
2. Three hundred sixty-two ; four hundred eleven.
3. Eight hundred ninety ; seven hundred eighty-eight.
4. Six hundreds, four tens, seven ones.
5. Two thousand one hundred twelve.
6. Four thousand six hundred eighty-one.
7. Eight thousand nine hundred twenty-four.
8. Seven thousand seventy-nine.
9. Nine thousands, four hundreds, six tens, three ones.

NOTE. The teacher will dictate additional numbers.



10 hundreds,  
1 thousand,  
1000.



10 tens,  
1 hundred,  
100.



10 ones,  
1 ten,  
10.



1 one,  
1.

- 12.** 10 ones are 1 ten.  
10 tens are 1 hundred.  
10 hundreds are 1 thousand.

**13.** Orders of Units are the successive units formed by taking together ten ones, ten tens, ten hundreds, and so on. Thus,

Ones are units of the *first order* ;  
Tens are units of the *second order* ;  
Hundreds are units of the *third order* ;  
Thousands are units of the *fourth order* ;

and so on.

**14.** When *five* figures are used to express a number, the left-hand figure represents *units of the fifth order*, and has the place-name *ten-thousands*. Thus,

10000 is 1 ten-thousand, or ten thousand.

20000 is 2 ten-thousands, or twenty thousand.

60000 is 6 ten-thousands, or sixty thousand.

10 thousands make 1 ten-thousand.

**1.** In 34567 which figure expresses thousands ?  
Which hundreds ? Which ten-thousands ?

**2.** In 54907 which figure expresses units of the fourth order ? Which units of the fifth order ?



**15.** When *six* figures are used to express a number, the left-hand figure represents *units of the sixth order*, and has the place-name *hundred-thousands*. Thus,

100000 is 1 hundred-thousand.

400000 is 4 hundred-thousand.

700000 is 7 hundred-thousand.

10 *ten-thousands* make 1 *hundred-thousand*.

**16.** The fifth and fourth order of units and the sixth, fifth, and fourth order of units are usually read together as so many thousands. Thus,

93000 is read ninety-three thousand.

764000 is read seven hundred sixty-four thousand.

**17.** A **Group**, or **Period**, is each successive three orders of units, beginning with ones.

The *Group of Ones* contains the ones, tens, and hundreds.

The *Group of Thousands* contains the ones, tens, and hundreds of thousands.

The comma may be used to separate groups. Thus,  
796,843 is read seven hundred ninety-six thousand eight hundred forty-three.

**3.** In 436897 which figure expresses units of the sixth order? Which hundred-thousands?

**4.** In 834768, which figures make the ones' group?

**5.** In 689432, which figures make the thousands' group?

**18. EXERCISES.**

Read the following numbers :

1.	2.	3.	4.
27 651	341 964	600 030	649 004
33 849	807 309	709 065	333 666
49 768	480 462	847 080	824 983
39 409	964 811	800 007	908 090
78 988	900 400	700 081	340 049

Write the following numbers in figures :

5. Sixty-four thousand eight hundred twenty-one
6. Eighty-one thousand four hundred sixty-nine.
7. Ninety-eight thousand forty-four.
8. One hundred ten thousand one hundred ten.
9. Two hundred forty-six thousand eighty-nine.
10. Seven hundred eighty-eight thousand eleven.

NOTE. The teacher will dictate additional numbers.

**19.** A **Decimal** is a number written at the right of the ones' place.

**20.** A point (.), called the *decimal point*, is always written at the left of a decimal, and separates it from the ones' figure.

**21.** The *first* order at the right of the point is *tenths*.

The *second* order at the right of the point is *hundredths*.

The *third* order at the right of the point is *thousandths*.

Thus,

0.5 is read 5 tenths,  
 0.17 is read 17 hundredths,  
 0.075 is read 75 thousandths,  
 2.05 is read 2, and 5 hundredths.  
 15.605 is read 15, and 605 thousandths.

NOTE. In reading a number, never use *and* except between the ones and the decimal to indicate the decimal point.

In writing a decimal without other figures the ones' place may be filled with a zero.

## 22. EXERCISES.

Read the following numbers :

1.	2.	3.	4.	5.
0.4	5.015	67.5	0.83	89.76
0.52	8.03	84.92	9.083	898.431
0.681	9.47	6.004	4.87	20.002
0.03	6.25	60.04	69.83	84.069
0.005	8.009	600.4	42.85	8.763

Write the following :

6. 8 tenths; 6 tenths; 4 tenths; 10 and 5 tenths.
7. 3 hundredths; 18 hundredths; 7 and 84 hundredths.
8. 2 thousandths; 24 thousandths; 18 and 217 thousandths.
9. 173 and 64 thousandths; 108 and 7 hundredths.
10. 2147 and 3 tenths; 3 and 48 hundredths.

NOTE. Additional exercises should be dictated by the teacher.

**23.** Notation is writing numbers in figures.

**24.** Numeration is reading numbers written in figures.

**25.** The method of writing numbers, and the names of units, places, and groups are shown in the following

**TABLE**

ORDERS OF UNITS	9th.	8th.	7th.	6th.	5th.	4th.	3d.	2d.	1st.	1st.	2d.	3d.
	Hundred-millions	Ten-millions	Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths
PLACE-NAMES												
FIGURES	5	4	0	7	9	3	1	5	4		6	3
	3d.			2d.			1st.				1st Decimal.	
GROUPS	Millions,			Thousands,			Ones,				Thousandths.	
GROUP-NAMES												

The number in the table is five hundred forty *million* seven hundred ninety-three *thousand* one hundred fifty-four, and six hundred thirty-eight *thousandths*.

**26.** The last place-name in each group is the group-name. The groups above millions are *billions*, *trillions*, etc. The decimal groups below thousandths are, *millionths*, *billionths*, etc.

## 27. EXERCISES.

Read 24876541.54.

*Solution.* — Beginning at the decimal point, we separate the number into groups, and have 24,876,541.54; then, beginning at the left, we read each group as if it stood alone, adding the group-name, thus: Twenty-four *million* eight hundred seventy-six *thousand* five hundred forty-one, and fifty-four hundredths.

It is not necessary to add the group-name in reading the ones' group. We read the decimal as if it stood alone and add the place-name of the last figure.

Read the following numbers:

1.	2.	3.	4.
49683.05	847084	2468391	8792.46
87051.19	938.765	476.81	918.32
6493.843	200407	3042.09	164789
3496.421	894.605	811.003	3498200
8796421	1847921	4000.004	80090700

Write the following numbers in figures:

5. Sixty-three thousand eighty, and seven tenths.
6. Four hundred thousand ninety-one, and twelve hundredths.
7. Three million three hundred, and thirty thousandths.
8. Seven hundred eighty-four, and ninety-six thousandths.
9. Eighty-seven million eighty-seven thousand eighty-seven.
10. Nine thousand ninety-nine, and five tenths.
11. Three hundred fifty-eight thousand two hundred six.
12. Nine million sixty-four thousand sixty-six.
13. Eight hundred eight thousand two hundred seven.
14. Ninety-nine thousand, and ninety-nine hundredths.

**28.** *Ten of any order of units make one of the next larger order.*

## ADDITION.

**29. Inductive Exercises.** — 1. I have 3 cents in my right hand and 2 cents in my left. How many shall I have if I put them together?

2. How many books are 3 books and 4 books put together?

3. How many boys are 4 boys and 2 boys?

4. What number do you obtain by uniting 5 ones and 4 ones?

5. What number contains as many ones as 5 and 6 united?

6. How many caps are 4 caps and 6 caps?

7. How many are 3 pencils and 7 pencils? 4 figs and 7 figs?

8. James had 8 cents and found 3 more. How many did he have then? 8 and 3? 3 and 8?

9. A lady had 7 birds in a large cage and 5 birds in a small cage. She put them all into the large cage. How many did it then contain?

10. How many are 7 ones and 6 ones? 7 tens and 6 tens?

11. There are 6 scholars in one row and 8 in another. How many in both rows? 8 and 6? 6 and 8?

12. How many are 4 dollars and 3 dollars? What is one of 4 dollars? One of 3 dollars? What is the unit of each?

**30. Like Numbers** are numbers having the same unit. Thus, 3, 5, 7; 2 cents and 4 cents are like numbers.

**31. Addition** is finding a number equal to two or more given numbers.

Only like numbers can be added.

**32. The Sum, or Amount,** is the result of an addition.

**33. The Sign of Addition** is +, named *plus*. It means *more*, and is generally read *and*.

**34. The Sign of Equality** is =. It means *equal, or equal to*, and may be read *are*.

Thus,  $3 + 4 + 5 = 12$ , is read three and four and five are twelve.

**35. The Dollar Sign, \$,** means *dollars*.

Thus, \$ 5 is read five dollars.

**36. 1.** From the following select the like numbers and add them: 3 quarts, 6 cents, 5 inches, 9 quarts, 4, 8 inches, 17 miles, \$ 8, 7 inches, 14, 3 cents, 2 inches, 2 miles, \$ 16, 5.

**2.**  $6 + 4 = ?$   $5 + 5 = ?$   $8 + 2 = ?$   $7 + 1 + 3 = ?$

**3.** Add \$ 2, \$ 3, and \$ 6.      **4.** \$ 8, \$ 10, and \$ 4.

**5.** What is the sum of 2, 3, 5, 6, and 1?

**6.** Find the amount of 7, 3, 6, and 4.

**7.** What number is equal to 7 pounds and 4 pounds?

**8.** By the use of signs write 6 and 3 and 4 are 13.

**9.** The parts of a number are 4 and 6. What is the number?

**37. ORAL EXERCISES.**

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	1	1	5	5	6	6	1	1	4	2
2.	2	1	6	4	7	6	4	6	3	5
3.	3	1	7	3	9	7	3	5	7	8
4.	4	1	8	5	7	8	6	4	9	5
5.	2	2	6	3	9	8	5	7	6	2
6.	2	3	5	4	7	5	7	8	5	7
7.	4	2	8	3	8	8	8	2	9	3
8.	2	5	4	8	6	9	9	6	1	7
9.	1	9	2	9	5	7	1	2	8	3
10.	3	3	4	4	9	6	2	9	4	1

Give the sum of the numbers in each line in

- |                     |                      |
|---------------------|----------------------|
| 1. Columns 1 and 2. | 6. Columns 6 and 7.  |
| 2. Columns 2 and 3. | 7. Columns 7 and 8.  |
| 3. Columns 3 and 4. | 8. Columns 8 and 9.  |
| 4. Columns 4 and 5. | 9. Columns 9 and 10. |
| 5. Columns 5 and 6. |                      |

Add the numbers in each column in

- |                    |                     |
|--------------------|---------------------|
| 10. Lines 1 and 2. | 15. Lines 6 and 7.  |
| 11. Lines 2 and 3. | 16. Lines 7 and 8.  |
| 12. Lines 3 and 4. | 17. Lines 8 and 9.  |
| 13. Lines 4 and 5. | 18. Lines 9 and 10. |
| 14. Lines 5 and 6. |                     |

19. In the same way give the sums of sets of *three* or more numbers from each line or column.

NOTE. Drill upon these exercises is recommended until the pupil acquires great facility in adding.



**38. WRITTEN EXERCISES.**

**1.** Add 5, 4, 3, and 2.

**5**      *Solution.* — Write the numbers in a column. Be-  
**4**      gin at the bottom, and add upwards, naming results,  
**3**      thus : 2, 5, 9, 14 ; sum 14, which write under the  
**2**      numbers added.  
**14**      To test the work, begin at the top, and add down-  
          wards, thus : 5, 9, 12, 14 ; sum as before, 14.

2.	3.	4.	5.	6.	7.	8.	9.	10.
2	3	4	6	5	6	5	5	7
3	4	3	3	6	2	0	5	5
2	1	5	2	2	3	4	6	6
1	2	2	4	3	2	5	8	4
<u>2</u>	<u>3</u>	<u>1</u>	<u>1</u>	<u>4</u>	<u>1</u>	<u>3</u>	<u>2</u>	<u>7</u>

11.	12.	13.	14.	15.	16.	17.	18.
20	40	50	40	200	300	300	800
30	80	40	50	400	500	400	400
60	20	70	80	800	600	800	900
70	60	60	70	600	700	900	700
<u>40</u>	<u>90</u>	<u>80</u>	<u>30</u>	<u>400</u>	<u>800</u>	<u>900</u>	<u>600</u>

When there are no ones in the ones' column, or tens in the tens' column, we write 0 under the column in the sum.

- 19.** Add 6, 4, 3, 9, 8, 7.    **24.** Add 80, 40, 60, 90.  
**20.** Add 4, 7, 6, 9, 9, 3.    **25.** Add 800, 900, 700, 600.  
**21.** Add 7, 9, 8, 6, 5, 4.    **26.** Add 32, 41, 63, 72.  
**22.** Add 6, 4, 7, 3, 2, 0.    **27.** Add 801, 932, 412, 623.  
**23.** Add 7, 3, 2, 9, 3, 1.    **28.** Add 411, 622, 733, 821.

**39. ORAL EXERCISES.**

3, 7, 5, 2, 9, 4, 8, 1, 6.

1. To the numbers above add 1.

2. Add 2. 4. Add 4. 6. Add 6. 8. Add 8.

3. Add 3. 5. Add 5. 7. Add 7. 9. Add 9.

12, 22, 32, 53, 43, 73, 64, 94, 84.

10. To the numbers above add 1.

11. Add 2. 13. Add 4. 15. Add 6. 17. Add 8.

12. Add 3. 14. Add 5. 16. Add 7. 18. Add 9.

19. Count by 2's from 0 to 50.

Count

20. By 2's from 1 to 51. 23. By 4's from 0 to 60.

21. By 3's from 0 to 60. 24. By 4's from 2 to 62.

22. By 3's from 1 to 61. 25. By 4's from 1 to 61.

26.  $6 + 4 + 9 + 5 = ?$  30.  $37 + 5 + 6 + 7 = ?$

27.  $17 + 8 + 5 + 9 = ?$  31.  $83 + 9 + 7 + 8 = ?$

28.  $18 + 7 + 6 + 8 = ?$  32.  $64 + 7 + 3 + 9 = ?$

29.  $23 + 4 + 9 + 3 = ?$  33.  $73 + 9 + 4 + 9 = ?$

34. I paid 13 cents for paper and 8 cents for pens.  
How much did I pay for both?

35. A boy gave 60 cents for a knife and 30 cents for  
a ball. How much did he give for both?

36. How many are 60, 20, 30, 50, and 40?

**40. WRITTEN EXERCISES.**

1. What is the sum of 595, 361, and 723?

595

361

723

1679

*Solution.* — We write the numbers so that units of the same order may be in the same column.

We add, beginning with ones, thus: 3, 4, 9; sum, 9 ones, which we write under the line in ones' place.

We add the tens, thus: 2, 8, 17; sum, 17 tens, or 1 hundred 7 tens. We write under the line the 7 tens in the tens' place, and add the 1 hundred with the hundreds in the next column.

We add the hundreds, thus: 1, 8, 11, 16; sum, 16 hundreds, or 1 thousand 6 hundred. We write under the line the 6 hundreds in the hundreds' place and the 1 thousand in the thousands' place.

The sum is 1 thousand 6 hundreds 7 tens 9 ones, or 1679.

Copy and add

2.	3.	4.	5.	6.	7.	8.
417	512	327	82.1	964	6.41	360
210	719	895	41.3	218	8.21	249
<u>164</u>	<u>614</u>	<u>476</u>	<u>72.8</u>	<u>317</u>	<u>3.99</u>	<u>341</u>

9.	10.	11.	12.	13.	14.	15.
427	621	86.4	381	847	2.18	543
641	743	3.2	624	169	3.99	91
831	82	91.7	87	83	4.00	176
<u>98</u>	<u>9</u>	<u>16.4</u>	<u>99</u>	<u>946</u>	<u>8.16</u>	<u>868</u>

Find the sum of

16. 349, 827, 943, 864.

18. 3468, 2978, 4319.

17. 92, 84, 69, 73, 24.

19. 84.9, 683.2, 9.1.

**41. ORAL EXERCISES.**

15, 35, 26, 46, 67, 57, 58, 78, 69, 89.

1. To the numbers above add 1.

2. Add 2.      4. Add 4.      6. Add 6.      8. Add 8.

3. Add 3.      5. Add 5.      7. Add 7.      9. Add 9.

10. Count by 3's from 2 to 62.

11. Count by 5's from 0 to 100. From 1 to 51.

12. Gave \$9 for coal and \$11 for wood. What did both cost?

13. Name three like numbers. Two unlike numbers.

14. A tailor sold a hat for \$7, a vest for \$3, and a coat for as much as he received for hat and vest. How much did he receive in all?

15. James paid 18 cents for a speller and 32 cents for a reader. What did he pay for both?

16. Add 7, 8, 6, 5, 4, 3, 9, 2, 1.

17. In a horse-car 10 ladies are sitting on one side and 12 gentlemen on the other. There are 5 passengers on the platform. How many people are there on the car, counting the driver and the conductor?

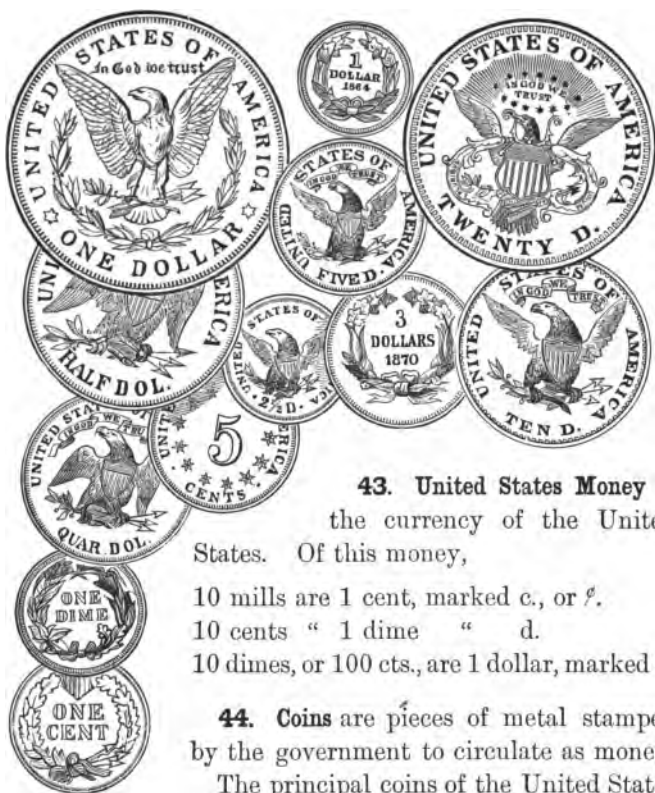
18. How many are 7 tens and 5 ones added to 8 tens and 4 ones?

19. If your slate is 12 inches long and 10 inches wide, what is the distance around it?

20.  $18 + 3 + 9 + 8 + 7 + 7 + 4 + 9 + 3 = 1$

**42. WRITTEN EXERCISES.**

		<i>Solution.</i>	
<b>A.</b>	1. Select from column A the	l =	927
a 4678	number opposite each letter of	a =	4678
b 2943	the word <i>land</i> , and add the four	n =	6270
c 381	numbers.	d =	1469
d 1469	Add the numbers correspond-	Sum,	13344
e 8325	ing to the letters in the follow-		
f 6749	ing words :		
g 8491	2. snow	22. motion	42. twilight
h 684	3. lamb	23. conduct	43. jumping
i 789	4. beau	24. canker	44. absences
j 4762	5. care	25. juices	45. creatures
k 84	6. cloud	26. zebras	46. printers
l 927	7. cruel	27. golden	47. fretful
m 5834	8. snake	28. noisy	48. kindness
n 6270	9. doubt	29. pretty	49. quality
o 8597	10. short	30. parched	50. vanity
p 8046	11. pearl	31. fought	51. chimneys
q 3982	12. quill	32. scholars	52. brakeman
r 4765	13. frail	33. addition	53. recover
s 6481	14. erase	34. carriage	54. wharves
t 983	15. doing	35. weights	55. chocolate
u 8435	16. friend	36. industry	56. engraving
v 1764	17. ladies	37. bracelet	57. finished
w 4787	18. brutes	38. article	58. favorite
x 9408	19. strong	39. razors	59. beautiful
y 6967	20. whose	40. strength	60. misfortune
z 7384	21. gnawed	41. working	61. deliverance



43. United States Money is the currency of the United States. Of this money,

10 mills are 1 cent, marked c., or ¢.

10 cents " 1 dime " d.

10 dimes, or 100 cts., are 1 dollar, marked \$.

44. Coins are pieces of metal stamped by the government to circulate as money. The principal coins of the United States are :

The cent, made of *bronze* ; the five-cent piece, made of *nickel* ; the dime, quarter-dollar, half-dollar, and dollar, made of *silver* ; the dollar, two-and-a-half-dollar, three-dollar, five-dollar, ten-dollar, and twenty-dollar coins, made of *gold*. The ten-dollar coin is called an eagle.

**45.** Cents are *hundredths* and mills *thousandths* of a dollar. Cents occupy two decimal places, tenths and hundredths, and mills the thousandths' place. Thus, Fifteen dollars twenty-seven cents is written \$15.27, and sixty-two cents five mills, \$.625.

**46.** When the number of cents is less than ten, the cipher must occupy the tenths' place. Thus,  
8 cents is written \$.08, or \$0.08.

Eagles, dimes, and mills are little used in ordinary business transactions.

#### 47. EXERCISES.

1. Add \$.25, \$.10, \$.50, and a quarter of a dollar.
2. Add \$.07, \$0.09, \$.12, and 15 cents.
3. Add a dime, a quarter, and a half-dollar.
4. What six coins make a dollar?
5. What nine coins make \$7?

Add

6.	7.	8.	9.	10.	11.
\$14.27	\$13.25	\$192.37	\$0.64	\$34.70	\$856
8.43	.50	86.41	0.85	8.64	194
9.75	3.88	9.38	0.83	9.21	983
8.26	6.41	4.75	9.41	8.64	765

**12.** Add \$14.72, \$6.84, \$9.21, \$0.75, \$8.14, and \$25.

**13.** Add \$8.94, \$7.75, \$2.50, \$82.75, \$375, \$8.69.

**14.** Add \$37.68, \$94.86, \$75.24, \$651.84, \$482.45.

**48. ORAL EXERCISES.**

1. Seventeen is the sum of what two numbers, each less than 10?

2. Add 3000, 400, 80, 5, and 4.

3. How old shall you be in 8 years?

4. Count by 6's from 2 to 62.

5. Find the sum of 8, 4, 9, 6, 5, 4, 3, and 7.

6. How much money is there in a purse that contains a dollar, a half-dollar, a quarter, two dimes, and a five-cent piece?

7. I bought a dozen eggs for 20 cents, some steak for 37 cents, some oil for 15 cents, and had 3 cents left. How much had I at first?

8. Find the sum of the first nine numbers.

9. How much money would you have if your teacher should make you a present of one of each of the gold coins of this country?

10. James paid out \$1.20 and \$.50, and had a quarter and 3 dimes left. How much had he at first?

11. Begin at 9 and add by 7's to 79.

12. When our flag was first made it contained 13 stars. Since then 25 more have been added. How many does it now contain?

13. Sarah bought ribbon for 12 cents, braid for 8 cents, and thread for 5 cents. What three coins would pay for all?

14. See how rapidly you can give the sum of the digits in each number in column A, page 17.



**49. WRITTEN EXERCISES.**

1.	2.	3.	4.	5.
\$ 69.82	\$ 843.94	\$ 26.84	\$ 346.	\$ 847.62
74.38	27.69	93.75	982.	987.64
96.42	986.18	84.25	347.	321.83
2.95	48.88	69.83	92.86	842.98
<u>7.61</u>	<u>143.25</u>	<u>42.76</u>	<u>3.84</u>	<u>76.99</u>

6. A man bought a house, paying \$ 675 down, \$ 875 July 1st, \$ 1946 Oct. 1st, and \$ 285 at the end of the year; what did it cost him?

7. A merchant's sales were, Monday, \$ 246.75; Tuesday, \$ 17.36; Wednesday, \$ 84.96; Thursday, \$ 89.76; Friday, \$ 189.64; Saturday, \$ 391.76. What were his sales for the week?

a. Add 4768, 3947, 698, 47, 834, 9821.

9.	10.	11.	12.	13.
\$ 156.25	849	9831	\$ 694.20	\$ 345.21
84.72	683	4629	348.17	689.83
96.84	982	8046	865.92	987.96
73.21	149	3902	738.21	341.40
49.84	762	2949	469.34	249.75
<u>62.49</u>	<u>831</u>	<u>8639</u>	<u>294.87</u>	<u>684.50</u>

14. Add numbers a to l inclusive, in column A, page 17.

15. Add numbers m to z inclusive, in column A, page 17.

**50. ORAL EXERCISES.**

1. Mary has 19 apples, Jennie has 10, Hattie has 9, and Lulu has 5. How many have they all?

2. Fred Smith entered school when he was 6 years old. He spent 3 years in the primary department, 6 years in the grammar, 4 years in the high school, 4 years in college, and he has been 7 years in business. How old is he?

3. Count by 7's from 0 to 70. From 1 to 50.

4. A newsboy leaves 15 papers on one street, 17 on another, and 11 on another. How many papers does he carry?

5. I bought five chairs, paying \$6 for one, and \$8, \$7, \$10, and \$4 for the others. What did they cost me?

6. What is the value of the four smallest U. S. coins?

7. What are the four largest U. S. coins worth?

8. Frank paid \$.48 for a bat and \$1.25 for a ball. What did both cost?

9. Miss Taylor paid \$6 for a hat, \$2.50 for trimming, and \$1.25 for a pair of gloves. How much did she spend?

10. A gentleman spent a week in Washington, 10 days in New York, and a fortnight in Boston. If he spent 5 days in travelling, how many days was he away from home?

11. Add \$.37, one dollar, a dime, and half a dollar?

**51. WRITTEN EXERCISES.**

1. Edward read five books in a month. The first contained 216 pages, and the others 318, 414, 98, and 128 pages. How many pages did he read?

2. A lady who went shopping spent \$8.47 in one store, and \$4.96, \$3.28, and \$5.63 in three other stores. She had \$14.86 left. How much did she have when she started?

3. Five freight cars are loaded with coal. They contain 14876, 18472, 18491, 15834, and 16978 pounds, respectively. How many pounds are there in all?

4. James has \$2.17, Edward has \$1.25 more than James, and Charles has \$2.74 more than Edward. How much money have the three boys?

5. Bought the following articles at a grocery: what was the amount of my bill? Flour \$8.25, apples \$3.25, meal \$.87, butter \$4.96, raisins \$.54.

6. Add \$34.86, \$91.83, \$84.62, \$76.91, \$84.49.

7. What is the distance around your schoolroom if it is 32 feet long and 28 feet wide?

8. An engineer travels in a week 242 miles, 316 miles, 84 miles, 227 miles, 97 miles, and 199 miles. How far does he travel in all?

9. Mr. Clark owns three houses worth \$3875, \$4865, \$7830. What are they all worth?

10.  $9847 + 8596 + 78.34 + 92.15 = ?$

11. A purse worth \$2 contains the 9 largest U. S. coins. What are the purse and contents worth?

## SUBTRACTION.



**52. Inductive Exercises.** — 1. James has caught 6 trout and Henry 4. How many have both caught?

2. 6 and how many are 10? Take 4 from 10 and how many remain?

3. How many more fish has James caught than Henry? How many are 6 trout less 4 trout?

4. If James gives away 3 fish, how many will he have left? Take 3 from 6, and how many are left?

5. Eight cents are in a pocket-book; if I take away 5 cents, how many will remain?

6. Take 3 cents from 8 cents, and how many remain?

**53.** **Subtraction** is taking one of two like numbers from the other.

**54.** The **Difference**, or **Remainder**, is the result of a subtraction.

**55.** The **Subtrahend** is the number subtracted.

**56.** The **Minuend** is the number subtracted from.

**57.** The **Sign of Subtraction** is  $-$ . Its name is *minus*, which means *less*. Thus,

$$7 - 4 = 3, \text{ is read } 7 \text{ less } 4 \text{ are } 3.$$

**58.** 1. From \$8 take \$3. Subtract \$7 from \$10.

2. What is the difference between 9 and 4?

3. If the subtrahend is 7 and the minuend 9, what is the difference?

4. Mary had 12 eggs in her basket, but fell and broke 7 of them; how many were left?

5. What is the minuend in example 4? The subtrahend?

6.	7.	8.	9.
$8 - 4 = ?$	$14 - 7 = ?$	$7 - 3 = ?$	$11 - 6 = ?$
$10 - 6 = ?$	$13 - 6 = ?$	$9 - 6 = ?$	$14 - 8 = ?$
$12 - 7 = ?$	$17 - 7 = ?$	$5 - 2 = ?$	$16 - 6 = ?$
$15 - 6 = ?$	$18 - 9 = ?$	$10 - 5 = ?$	$17 - 8 = ?$
$15 - 7 = ?$	$13 - 5 = ?$	$16 - 4 = ?$	$17 - 9 = ?$
$14 - 6 = ?$	$12 - 6 = ?$	$11 - 5 = ?$	$11 - 4 = ?$
$18 - 8 = ?$	$12 - 4 = ?$	$10 - 3 = ?$	$12 - 3 = ?$

## 59. ORAL EXERCISES.

1.  $\left\{ \begin{array}{l} \text{From} \quad 4 \quad 8 \quad 5 \quad 1 \quad 9 \quad 3 \quad 2 \quad 7 \quad 10 \quad 6 \\ \text{Subtract} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \end{array} \right.$
2.  $\left\{ \begin{array}{l} \text{From} \quad 2 \quad 11 \quad 4 \quad 9 \quad 6 \quad 7 \quad 8 \quad 5 \quad 10 \quad 3 \quad 12 \\ \text{Subtract} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \quad \underline{2} \end{array} \right.$
3.  $\left\{ \begin{array}{l} \text{From} \quad 3 \quad 12 \quad 5 \quad 10 \quad 7 \quad 8 \quad 9 \quad 6 \quad 11 \quad 4 \quad 13 \\ \text{Subtract} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \quad \underline{3} \end{array} \right.$
4.  $\left\{ \begin{array}{l} \text{From} \quad 5 \quad 11 \quad 14 \quad 6 \quad 9 \quad 8 \quad 7 \quad 10 \quad 4 \quad 12 \quad 13 \\ \text{Subtract} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \quad \underline{4} \end{array} \right.$
5.  $\left\{ \begin{array}{l} \text{From} \quad 5 \quad 15 \quad 7 \quad 10 \quad 9 \quad 8 \quad 11 \quad 6 \quad 13 \quad 14 \quad 12 \\ \text{Subtract} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \quad \underline{5} \end{array} \right.$
6.  $\left\{ \begin{array}{l} \text{From} \quad 14 \quad 9 \quad 6 \quad 11 \quad 8 \quad 13 \quad 10 \quad 7 \quad 12 \quad 16 \quad 15 \\ \text{Subtract} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \quad \underline{6} \end{array} \right.$
7.  $\left\{ \begin{array}{l} \text{From} \quad 12 \quad 7 \quad 13 \quad 8 \quad 14 \quad 9 \quad 15 \quad 10 \quad 16 \quad 11 \quad 17 \\ \text{Subtract} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \end{array} \right.$
8.  $\left\{ \begin{array}{l} \text{From} \quad 8 \quad 14 \quad 9 \quad 15 \quad 10 \quad 16 \quad 11 \quad 17 \quad 12 \quad 18 \quad 13 \\ \text{Subtract} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \end{array} \right.$
9.  $\left\{ \begin{array}{l} \text{From} \quad 14 \quad 19 \quad 13 \quad 17 \quad 12 \quad 18 \quad 11 \quad 16 \quad 10 \quad 15 \quad 9 \\ \text{Subtract} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \end{array} \right.$
10.  $\left\{ \begin{array}{l} \text{From} \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \quad 20 \\ \text{Subtract} \quad \underline{1} \quad \underline{5} \quad \underline{9} \quad \underline{2} \quad \underline{6} \quad \underline{10} \quad \underline{3} \quad \underline{7} \quad \underline{9} \quad \underline{4} \quad \underline{8} \end{array} \right.$

NOTE. These exercises should be practiced until the pupil can give the differences rapidly at sight.

## 60. WRITTEN EXERCISES.

1. Subtract 463 from 897.

Minuend, 897

Subtrahend, 463

Difference, 434Proof, 897

*Solution.*— We write the subtrahend under the minuend so that figures of the same order are in the same column. 3 ones from 7 ones leave 4 ones, which we write beneath in ones' place; 6 tens from

9 tens leave 3 tens, which we write in tens' place; 4 hundreds from 8 hundreds leave 4 hundreds, which we write in hundreds' place.

The difference is 4 hundreds 3 tens 4 ones, or 434.

To prove the work correct, we add the subtrahend and the difference, and obtain the minuend.

	From	take		From	take		From	take
2.	869	414	13.	678	542	24.	8976	7434
3.	978	325	14.	945	323	25.	5432	4211
4.	897	671	15.	397	182	26.	8671	7550
5.	855	724	16.	649	621	27.	3945	2734
6.	677	352	17.	878	678	28.	8396	6274
7.	934	413	18.	776	525	29.	6421	2301
8.	422	220	19.	984	813	30.	8394	7273
9.	769	636	20.	329	127	31.	7878	5344
10.	947	523	21.	642	332	32.	6795	2573
11.	768	554	22.	804	702	33.	5483	1461
12.	686	175	23.	697	123	34.	2694	342

35. A man having \$8439 spent \$6317 for a house. How much had he left?

36. How much larger is 7856 than 3453?

**61. ORAL EXERCISES.**

11, 21, 51, 31, 81, 41, 71, 91, 61,

From each of the above numbers

- |                |                |                |
|----------------|----------------|----------------|
| 1. Subtract 1. | 4. Subtract 4. | 7. Subtract 7. |
| 2. Subtract 2. | 5. Subtract 5. | 8. Subtract 8. |
| 3. Subtract 3. | 6. Subtract 6. | 9. Subtract 9. |

How many are

- | 10.          | 11.           | 12.           | 13.            |
|--------------|---------------|---------------|----------------|
| $6 + 8 - 3?$ | $13 + 5 - 8?$ | $13 - 5 - 2?$ | $21 - 9 - 2?$  |
| $7 + 5 - 5?$ | $16 + 8 - 6?$ | $19 - 6 - 4?$ | $22 - 6 - 5?$  |
| $9 + 4 - 6?$ | $19 + 7 - 9?$ | $17 - 3 - 9?$ | $23 - 7 - 4?$  |
| $8 + 3 - 9?$ | $13 + 4 - 5?$ | $16 - 8 - 3?$ | $26 - 8 - 5?$  |
| $6 + 7 - 4?$ | $15 + 9 - 4?$ | $14 - 9 - 4?$ | $27 - 12 - 5?$ |

14. Subtract by 2's from 21 back to 1.

15. By 3's from 21 to 6.      19. By 4's from 33 to 1.

16. By 3's from 22 to 1.      20. By 5's from 49 to 4.

17. By 4's from 31 to 3.      21. By 5's from 47 to 2.

18. By 4's from 32 to 4.      22. By 5's from 46 to 1.

23. { From 12 32 72 42 92 22 62 52 82  
       { Take 4 3 4 3 4 3 4 3 4

24. { From 13 73 53 83 23 93 33 43 63  
       { Take 4 4 5 5 4 5 4 5 4

25. Take 5 from 14, 34, 84, 64, 74, 94, 44, 54.

26. Take 6.    27. Take 7.    28. Take 8.    29. Take 9.



**62. WRITTEN EXERCISES.**

- 1.**
- From 743 take 528.

Minuend, 743  
 Subtrahend, 528  
 Difference,  $\overline{215}$   
 Proof,  $\overline{743}$

*Solution.* — 8 ones cannot be taken from 3 ones ; we therefore take 1 ten, or 10 ones, from the 4 tens of the minuend, leaving 3 tens ; adding the 10 ones to the 3 ones, we have 13 ones ; 8 ones from 13 ones

leave 5 ones, which we write beneath in the ones' place.

2 tens from 3 tens leave 1 ten, which we write in tens' place ; 5 hundreds from 7 hundreds leave 2 hundreds, which we write in hundreds' place. The difference is 2 hundreds 1 ten 5 ones, or 215.

In subtracting we may simply say, 8 from 13, 5 ; 2 from 3, 1 ; 5 from 7, 2. Difference, 215.

	From	take		From	take
<b>2.</b>	647	559	<b>13.</b>	14563	12784
<b>3.</b>	876	677	<b>14.</b>	72912	64739
<b>4.</b>	943	856	<b>15.</b>	43274	18793
<b>5.</b>	842	391	<b>16.</b>	68317	54286
<b>6.</b>	3.65	2.78	<b>17.</b>	47696	31764
<b>7.</b>	49.1	39.8	<b>18.</b>	83459	12491
<b>8.</b>	876	683	<b>19.</b>	59541	32470
<b>9.</b>	9341	4776	<b>20.</b>	68395	61877
<b>10.</b>	12.68	9.790	<b>21.</b>	74216	31768
<b>11.</b>	14781	6845	<b>22.</b>	18764	4995
<b>12.</b>	16914	7859	<b>23.</b>	54912	48789

**24.** In a city containing 37842 people there are 3486 that cannot read or write. How many in the city can read and write ?

**63. ORAL EXERCISES.**

15, 25, 65, 45, 75, 55, 85, 35, 95.

From the above numbers

1. Take 6.    2. Take 7.    3. Take 8.    4. Take 9.  
 5. How many are 26 less 7?    46 less 7?    66 less 7?  
 6. 76 less 7?    86 less 7?    56 less 7?    36 less 7?  
 16 less 7?

$$7. \begin{cases} \text{From} & 17 & 67 & 47 & 77 & 97 & 37 & 57 & 87 & 27 \\ \text{Take} & \underline{8} & \underline{8} & \underline{8} & \underline{8} & \underline{8} & \underline{8} & \underline{8} & \underline{8} & \underline{8} \end{cases}$$

$$8. \begin{cases} \text{From} & 18 & 28 & 38 & 58 & 78 & 88 & 98 & 48 & 68 \\ \text{Take} & \underline{9} & \underline{9} & \underline{9} & \underline{9} & \underline{9} & \underline{9} & \underline{9} & \underline{9} & \underline{9} \end{cases}$$

9. Subtract by 2's from 61 to 21.  
 10. By 3's from 37 to 7.    15. By 7's from 69 to 6.  
 11. By 4's from 54 to 6.    16. By 8's from 82 to 2.  
 12. By 5's from 49 to 4.    17. By 9's from 95 to 5.  
 13. By 6's from 67 to 1.    18. By 8's from 61 to 5.  
 14. By 7's from 70 to 0.    19. By 9's from 84 to 3.

20.	21.	22.
$6 + ? = 19$	$18 + 7 - 9 = ?$	$40 - 7 - 8 - 9 = ?$
$23 - ? = 17$	$16 + 9 + ? = 37$	$27 - 4 - 5 - 7 = ?$
$21 + ? = 32$	$27 - 4 - 5 = ?$	$62 - 3 - 4 - 8 = ?$
$32 - 9 = ?$	$63 - 8 - 9 = ?$	$17 + 5 - 8 + 3 = ?$
$17 - 8 = ?$	$41 - 7 - 8 = ?$	$82 - 9 + 5 - 4 = ?$
$19 - ? = 7$	$69 - 4 + 9 = ?$	$37 - 4 - 4 - 7 = ?$
$30 - ? = 18$	$61 - 40 - 7 = ?$	$64 - 9 - 8 - 8 = ?$
$41 - 9 = ?$	$43 - 20 - 5 = ?$	$41 - 21 - 5 - 6 = ?$

**64. WRITTEN EXERCISES.**

1. Find the difference between 7400 and 245.

$$\begin{array}{r} \textcircled{8} \textcircled{9} \textcircled{10} \\ 7 \ 4 \ 0 \ 0 \\ \underline{2 \ 4 \ 5} \\ 7 \ 1 \ 5 \ 5 \end{array}$$

*Solution.* — There being 0 ones to take the 5 ones from, and 0 tens to take the 4 tens from, we take 1 from the 4 hundreds, leaving 3 hundreds, and change it to 10 tens; we then take 1 of the 10 tens, leaving 9 tens, and change it to 10 ones. The minuend now becomes 7 thousands, 3 hundreds, 9 tens, 10 ones, and subtracting from this 2 hundreds, 4 tens, 5 ones, we obtain the difference, 7155.

In subtracting we may simply say, 5 from 10, 5; 4 from 9, 5; 2 from 3, 1; 0 from 7, 7. The difference, 7155.

	2.	3.	4.	5.
From	4160	8400	4708	1009
Take	<u>1354</u>	<u>3219</u>	<u>1562</u>	<u>138</u>

	6.	7.	8.	9.
From	\$47.00	\$23.06	\$99.50	\$65.00
Take	<u>3 25</u>	<u>18.17</u>	<u>63.83</u>	<u>19.05</u>

- |                 |                         |
|-----------------|-------------------------|
| 10. 4006 — 340  | 19. \$132.28 — \$20.37  |
| 11. 2610 — 1102 | 20. \$119.65 — \$84.91  |
| 12. 1007 — 119  | 21. \$847.61 — \$648.75 |
| 13. 4708 — 892  | 22. \$324.00 — \$198.74 |
| 14. 5987 — 1051 | 23. \$483.76 — \$319.86 |
| 15. 4062 — 984  | 24. \$683.75 — \$421.75 |
| 16. 7910 — 6472 | 25. \$840.00 — \$96.19  |
| 17. 8008 — 7394 | 26. \$648.32 — \$84.79  |
| 18. 6234 — 4271 | 27. \$785.19 — \$784.27 |

**65. ORAL EXERCISES.**

1. Jane had 15 cents, but spent 7 cents for thread. How much had she left?

2. Out of 25 words Edward missed 6. How many did he spell correctly?

3. James is fourteen years old and his sister is 5 years younger. How old is his sister?

4. The subtrahend is 7 and the minuend 12. What is the difference? Prove it.

5. A man who had \$21 gave \$9 for a coat. How much had he left?

6. George bought a slate for 8 cents and a pencil for 4 cents. He gave the dealer a quarter of a dollar. How much change should he receive?

7. Susie had 20 cents. She spent 8 cents at one time and 7 cents at another. How much had she left?

8. A boy 16 years old has been in school 8 years. How old was he when he began to go to school?

9. In how many years will you be 20 years old if you are 9 years old now?

10. When the sun rises at four o'clock, how many hours does it shine before noon?

11. Take the sum of 6 and 8 from the sum of 9 and 10.

12. Take the sum of half a dollar and two dimes from a dollar.

13. A boy who had 13 cents earned 12 more, and then spent 9 cents. How much had he left?

**66. WRITTEN EXERCISES.**

1. Mr. Davis had \$12.68 in his pocket-book, but spent \$5.97. How much had he left?

2. A class of 54 scholars spelled 2486 words and missed 197. How many were spelled right?

3. Washington died in 1799 at the age of 67. In what year was he born?

4. The subtrahend is 9478 and the minuend 12401. What is the difference? Prove it.

5. A gentleman having \$10,000 bought a house for \$7425. How much had he left?

6. Mrs. Wright went to Boston with \$20. She bought silk for \$8.47 and velvet for \$7.94. How much had she left?

7. A farmer had 2491 acres of land. He sold 842 acres to one man and 967 acres to another. How many acres remained?

8. Noah died at the age of 950 years. He lived 350 years after the Flood. How old was he when he went into the ark?

9. July 4, 1882, was the 106th anniversary of our independence. In what year will the 200th anniversary occur?

10. The year has 365 days. The first five months have 151 days. How many days have the remaining seven months?

11. Take the sum of 847 and 295 from the sum of 647 and 939.

**67. ORAL EXERCISES.**

1. I paid 50 cents for a hammer, 25 cents for a screw-driver, and 15 cents for a gimlet. I gave the dealer a two-dollar bill. How much did he return me ?

2. From the sum of 15 and 40 take their difference ?

3. James owes John 28 cents and John owes James 15 cents. How shall they settle ?

4. Sold a watch for \$100 and a chain for \$40. Received in payment a horse valued at \$125. How much is still due me ?

5. Mr. Adams earned \$16 one week and \$18 the next. His expenses were for board \$5 each week, for wood \$2, for clothing \$9. How much had he left ?

6. Mary had \$0.18 and earned \$0.12 more. She then spent a dime and lost a nickel. What had she left ?

7. What number taken from 37 leaves 24 ?

8. What number added to 350 makes 550 ?

9. Take  $8 + 9 + 5$  from  $39 - 7$ .

10. If you should travel east 40 rods, then west 18 rods, and then east 6 rods, how far would you be from your starting place ?

11. James has 6 cents less than Henry, who has 12 cents less than Mary. Mary has 25 cents. How much has James ?

12. John was sent for the doctor at a quarter of 10 o'clock. He was 10 minutes in going and 15 minutes in returning. What time was it when he returned ?

**68. WRITTEN EXERCISES.**

1. I bought wood for \$16.78, coal for \$28.94, and paid \$2.87 for freight. How much had I left of a hundred-dollar bill?

2. Take the difference between 247 and 9491 from their sum.

3. Mr. Rice owes his brother \$173.91 and his brother owes him \$219.07. How shall they settle?

4. I have bought a house for \$7389 and land for \$6400. I have paid \$4596. How much do I still owe?

5. My income in March was \$169.84, and in April \$284.75. My expenses were for rent \$45 for each month, for clerk-hire \$40, and for sundries \$21.64. How much were my profits?

6. A man went into business with \$5000 and gained \$2400. He spent \$2900 and lost \$435 in bad debts. How much remained?

7. What number taken from 987 leaves 698?

8. Mr. Smith owes me \$18.75 for rent and \$16.84 for horse-hire. I owe him \$7.82 for labor, and \$6.78 for milk. How shall we settle?

9. My horse cost \$75 less than my carriage, and my carriage \$285 less than my daughter's piano, for which I paid \$800. What did my horse and carriage cost?

10. Take 649 less 288 from 847 — 95.

11. What is the difference between  $84 + 97$  and 3000?

**69. ORAL EXERCISES.**

1. I bought a yacht for \$ 800 and sold it for \$ 1250. What did I gain?

2. Mr. Rich sold for \$ 1600 a span of horses that cost him \$ 2000. What did he lose?

3. Subtract the minuend of exercise 1 from the subtrahend of exercise 2.

4. I bought 19 cents worth of paper and handed the stationer a dollar-bill. He returned me four coins. What were they?

5.  $84 - 9 - 8 - 7 - 6 - 5 - 4 - 3 - 2 - 1 = ?$

6. In a school there are 20 scholars in the first class, 18 in the second, and 22 in the third. When 5 scholars are absent from each class how many are present in all?

7. If you go to bed at 9 o'clock and rise at 6 o'clock how many hours are you awake in a day?

8. If you go into the country on the 18th of August and stay until the 31st, how many days do you stay?

9. How much more than 12 is the difference between 42 and 19?

10. Howard bought 20 cents' worth of rice and 34 cents' worth of oil. He gave a dollar to the grocer, who handed him back a quarter and two dimes. Was this the right change?

11.  $1400 - 800 + 500 - 300 + 200 - 500 = ?$

12. From a piece of cloth 37 yards in length a merchant sold 18 yards. How much remained?



**70. WRITTEN EXERCISES.**

1. Mr. Stevens who had \$762 in the bank and \$641.75 in his safe, paid three bills amounting to \$72.84, \$287.84, and \$384.76. How much had he left?

2. The minuend is \$849.75 and the remainder is \$198.84. Find the subtrahend.

3. A merchant received \$476.25. He paid out \$218.75 and then received \$684.18. He afterwards paid out \$629.94. How much had he left?

4.  $1946 + 8512 - 7639 + 19496 - 3254 = ?$

5. How many must be taken from a million to leave 847391?

6. The sum of three numbers is 49768. One of them is 16849, and another is 5947. What is the third?

7. The population of Syracuse in 1880 was 51791. It had gained 8740 in 10 years. What was its population in 1870?

8. A balloon rises 8476 feet, then descends 2924 feet, and then rises 4280 feet. What is its greatest distance from the ground?

9. A ship sails east 3127 miles, then west 2149 miles, and then east 849. How far is she from her starting place?

10. Take the difference between 17498 and 23174 from their sum.

11. Add \$64.87 to \$89.76 - \$9.98.

## MULTIPLICATION.

**71. Inductive Exercises.** — 1. How many cents are 5 cents and 5 cents and 5 cents?  $5 + 5 + 5 = ?$

2. How many are three 5's? 3 times 5?

3. How many books are 4 books and 4 books and 4 books and 4 books and 4 books?

4. How many books are 4 books taken 5 times?

5.  $4 + 4 + 4 + 4 + 4$ , or five 4's, are how many?

6.  $5 + 5 + 5 + 5$ , or 5 taken 4 times, are how many?

7.  $\$3 + \$3 + \$3 + \$3 + \$3 + \$3$ , or 6 times  $\$3$  are how many?

8. How many are 2 and 2 and 2 and 2 and 2, or 5 2's?  $5 + 5$ , or two 5's?

9. Maud has four five-cent pieces. How many cents has she?  $5 + 5 + 5 + 5 = ?$

10. What will 4 quarts of milk cost at 10 cents a quart?  $\$0.10 + \$0.10 + \$0.10 + \$0.10 = ?$  Four 10's = ?

11. How many wings have 7 birds? Seven 2's = ?

12. If you earn 6 cents a day how many cents will you earn in 6 days?  $6 + 6 + 6 + 6 + 6 + 6 = ?$

13. 7 men and 7 men and 7 men and 7 men, or 4 times 7 men, are how many men?

14. Which would you rather have, 5 dimes or 10 5-cent pieces? Five 10's = ? Ten 5's = ?

**72. Multiplication** is taking a number as many times as there are ones in another.

**73. The Multiplicand** is the number taken or multiplied.

**74. The Multiplier** is the number that shows how many times the multiplicand is taken.

**75. The Product** is the result of a multiplication.

**76. The Factors** of a number are the numbers multiplied together to produce it. Thus, the factors of 8 are 2 and 4.

**77. The Sign of Multiplication** is  $\times$ . It means *multiplied by* or *times*. Thus  $3 \times 5$  may be read 3 multiplied by 5, or 3 times 5.

**78. A Concrete Number** is one in which some kind of unit is named. Thus, \$3, 4 weeks, 7 miles are concrete numbers.

**79. An Abstract Number** is one in which no particular kind of unit is named. Thus, 7, 4, 9, are abstract numbers.

**80. (1)** *The multiplier is always considered an abstract number.*

**(2)** *Multiplicand and product are always like numbers.*

**(3)** *The product is the same whatever the order of the factors.*

**81. ORAL EXERCISES.**

1. What is the result of taking \$7 four times?
2. A grocer sold five pounds of sugar at 12 cents a pound. How much did he receive?
3. In exercise 2 which number is the multiplier? Which is the multiplicand? Which must be considered abstract?
4. What are the factors of 12? Of 10? Of 18?
5. Read the following:  $4 \times \$5 = \$20$ .  $\$5 \times 4 = \$20$ . Which is the number multiplied? Which is the product? What is the denomination of each?
6. \$0.14; 165; 7 seconds; 8 pounds; 12; \$1.24; 18. Which of these numbers are abstract? Which are concrete? Which two are like numbers? Which three?
7. What is the product of  $\$2 \times 3$ ?  $\$5 \times 5$ ?

How many are

8.	9.	10.	11.	12.
$2 \times 2?$	$1 \times 1?$	$9 \times 2?$	$6 \times 4?$	$8 \times 1?$
$2 \times 6?$	$2 \times 0?$	$8 \times 4?$	$5 \times 1?$	$9 \times 6?$
$3 \times 5?$	$6 \times 1?$	$5 \times 4?$	$8 \times 2?$	$7 \times 5?$
$2 \times 3?$	$9 \times 3?$	$0 \times 5?$	$8 \times 5?$	$4 \times 4?$
$3 \times 4?$	$7 \times 4?$	$3 \times 3?$	$7 \times 3?$	$9 \times 1?$
$4 \times 2?$	$5 \times 2?$	$2 \times 1?$	$1 \times 7?$	$7 \times 7?$
$3 \times 2?$	$4 \times 1?$	$9 \times 9?$	$6 \times 5?$	$8 \times 6?$
$2 \times 7?$	$9 \times 5?$	$8 \times 7?$	$8 \times 8?$	$3 \times 1?$
$3 \times 6?$	$7 \times 6?$	$3 \times 8?$	$9 \times 4?$	$9 \times 7?$
$6 \times 6?$	$5 \times 5?$	$9 \times 9?$	$7 \times 0?$	$4 \times 8?$

**NOTE.** The above exercises contain all the primary combinations in multiplication.

**82. ORAL EXERCISES.**

- |       |   |          |                              |   |
|-------|---|----------|------------------------------|---|
| 1.    | { | Multiply | 9, 6, 4, 7, 8, 1, 5, 3, 0, 2 | 2 |
|       | { | by       |                              | 2 |
| <hr/> |   |          |                              |   |
| 2.    | { | Multiply | 4, 3, 9, 6, 2, 5, 0, 7, 1, 8 | 8 |
|       | { | by       |                              | 3 |
| <hr/> |   |          |                              |   |
| 3.    | { | Multiply | 2, 4, 3, 9, 1, 8, 7, 5, 0, 6 | 6 |
|       | { | by       |                              | 4 |
| <hr/> |   |          |                              |   |
| 4.    | { | Multiply | 4, 7, 2, 1, 6, 3, 9, 8, 5, 0 | 0 |
|       | { | by       |                              | 5 |
| <hr/> |   |          |                              |   |
| 5.    | { | Multiply | 0, 5, 8, 9, 3, 6, 1, 2, 7, 4 | 4 |
|       | { | by       |                              | 6 |
| <hr/> |   |          |                              |   |
| 6.    | { | Multiply | 9, 1, 5, 3, 6, 2, 0, 7, 8, 4 | 4 |
|       | { | by       |                              | 7 |
| <hr/> |   |          |                              |   |
| 7.    | { | Multiply | 4, 8, 7, 0, 2, 6, 3, 5, 1, 9 | 9 |
|       | { | by       |                              | 8 |
| <hr/> |   |          |                              |   |
| 8.    | { | Multiply | 7, 8, 2, 4, 9, 6, 3, 1, 5, 0 | 0 |
|       | { | by       |                              | 9 |
| <hr/> |   |          |                              |   |

**NOTE.** The pupil should be drilled upon the above and similar exercises until perfectly familiar with the elementary combinations in multiplication.

**9.** Perform the exercises above and add 2 to each product; add 3; add 4; add 5; add 6.

- |                   |                   |                   |                       |
|-------------------|-------------------|-------------------|-----------------------|
| <b>10.</b>        | <b>11.</b>        | <b>12.</b>        | <b>13.</b>            |
| $9 \times ? = 45$ | $5 \times ? = 35$ | $9 \times ? = 63$ | $6 \times ? + 3 = 45$ |
| $6 \times ? = 36$ | $8 \times ? = 72$ | $? \times 7 = 49$ | $5 \times ? + 2 = 37$ |
| $? \times 7 = 56$ | $? \times 7 = 28$ | $4 \times ? = 16$ | $4 \times 9 + ? = 39$ |

**83. WRITTEN EXERCISES.**

1. How many are  $156 \times 4$ ?

Multiplicand, 156  
Multiplier, 4  
Product,  $\overline{624}$

*Solution.* — We use the smaller of the two numbers as a multiplier, and write it under the ones of the multiplicand.

4 times 6 ones are 24 ones, or 2 tens 4 ones; we write the 4 ones beneath in ones' place and reserve the 2 tens; 4 times 5 tens are 20 tens, plus the 2 tens reserved, are 22 tens, or 2 hundreds 2 tens; we write the 2 tens in tens' place and reserve the 2 hundreds; 4 times 1 hundred are 4 hundreds, plus the 2 hundreds reserved, are 6 hundreds. The result is, 6 hundreds 2 tens 4 ones, or 624.

*When one or both factors contain a decimal the product must have as many decimal places as both factors together.*

How many are	Find the product of	Multiply
2. $217 \times 2$ ?	17. 4724 and 9.	32. \$456 by 4.
3. $476 \times 3$ ?	18. 3217 and 6.	33. \$318 by 5.
4. $218 \times 2$ ?	19. 6849 and 4.	34. \$942 by 6.
5. $947 \times 4$ ?	20. 3241 and 5.	35. \$8.41 by 7.
6. $832 \times 5$ ?	21. 6849 and 9.	36. \$3.92 by 8.
7. $946 \times 7$ ?	22. 8576 and 8.	37. \$6.75 by 9.
8. $851 \times 6$ ?	23. 3298 and 8.	38. \$4.18 by 7.
9. $247 \times 4$ ?	24. 7419 and 3.	39. \$28.34 by 3.
10. $684 \times 5$ ?	25. 6832 and 9.	40. \$19.16 by 3.
11. $325 \times 9$ ?	26. 4768 and 2.	41. \$32.78 by 8.
12. $769 \times 8$ ?	27. 9324 and 5.	42. \$94.61 by 4.
13. $548 \times 6$ ?	28. 4769 and 7.	43. \$68.39 by 9.
14. $839 \times 7$ ?	29. 3859 and 8.	44. \$46.84 by 6.
15. $641 \times 4$ ?	30. 7654 and 6.	45. \$27.50 by 5.
16. $297 \times 3$ ?	31. 8321 and 5.	46. \$18.91 by 7.

**84. ORAL EXERCISES.**

1. Count by 2's from 2 to 20.
2. By 3's from 3 to 30.
3. By 4's from 4 to 40.
4. By 5's from 5 to 50.
5. By 6's from 6 to 60.
6. By 7's from 7 to 70.
7. By 8's from 8 to 80.
8. Count by 9's from 9 to 90.
9.  $8 \times 2, - 7, \times 9, + 5 = ?$

**NOTE.** The comma is here used to show that the operation indicated by each sign is to be performed on the result of the preceding operation.

Find the result of

10.  $3 \times 8, - 7, - 9, \times 5.$
11.  $8 + 3, - 4, \times 7, + 8.$
12.  $2 \times 3, \times 9, - 4, + 9.$
13.  $6 \times 4, - 5, - 9, \times 8.$
14.  $6 + 9, - 7, \times 9, - 8.$
15.  $2 \times 2, \times 2, \times 2, + 9.$
16.  $6 \times 9, - 9, - 9, - 6.$
17.  $4 \times 7, - 8, - 7, + 9.$
18. What will 8 pounds of rice cost at 7 cents a pound?

*Solution.* One pound costs 7 cents. 8 pounds will cost 8 times 7 cents, or 56 cents.

Find the cost

19. Of 9 quarts at 8 cents a quart.
20. Of 7 chairs at \$6 each.
21. Of 7 bushels at \$3 per bushel.
22. Of 8 dozen eggs at 10 cents a dozen.
23. Of 6 oranges at 4 cents apiece.
24. Of 5 pencils at 6 cents each.
25. Of 8 tons of coal at \$6 per ton.
26. I sold 4 sheep for \$5 a head, and received \$12. How much was still due me?

**85. ORAL AND WRITTEN EXERCISES.**

1. What will 6 barrels of flour cost at \$ 8 per barrel ?  
247 barrels ?

2. If one ton of coal costs \$ 6, what shall I pay for  
9 tons ? For 165 tons ?

3. If you read 7 pages each day, how many pages  
will you read in a week ? In 365 days ?

4. If a boat sails 9 miles in an hour, how far will it  
sail in 6 hours ? In 24 hours ?

5. What will 7 acres of land cost at \$ 4 per acre ?  
At \$ 4.75 per acre ?

6. What will 8 bushels of sweet potatoes cost at \$ 2  
per bushel ? At \$ 2.38 per bushel ?

7. When flour is \$ 9 a barrel, how much must be  
paid for 9 barrels ? For 925 barrels ?

Find the cost

8. Of 8 yards of cloth at \$ 5 a yard. At \$ 5.45.

9. Of 7 pairs of shoes at \$ 3 a pair. At \$ 3.25.

10. Of 6 barrels of apples at \$ 2 per barrel. At \$ 2.65.

11. Of 9 crates of peaches at \$ 4 per crate. At \$ 3.84.

12. Of 8 yards of carpet at \$ 2 per yard. At \$ 2.25.

13. What will 7 acres of land cost at \$ 400 per acre ?  
At \$ 648 ?

14. What will 5 pianos cost at \$ 500 each ? At \$ 680  
each ?

15. If a pair of gloves costs \$ 2, what will 10 pairs  
cost ? 385 pairs ?



**86. WRITTEN EXERCISES.**

- 1.**
- Multiply 13 by 10; 13 by 100.

Multiplicand,	13	13
Multiplier,	10	100
Product,	<u>130</u>	<u>1300</u>

*Solution.* — 10 thirteens are the same as 13 tens, or 130.

Also, 100 thirteens are the same as thirteen hundreds, or 1300. That is,

To multiply by 10, 100, etc.

*Annex as many zeros to the multiplicand as there are zeros in the multiplier; when the multiplicand contains a decimal, move the decimal point as many places to the right as there are zeros in the multiplier.*

How many are

- 2.**  $78 \times 10$ ?    **6.**  $3.15 \times 100$ ?    **10.**  $\$7.35 \times 100$ ?  
**3.**  $162 \times 100$ ?    **7.**  $64.2 \times 10$ ?    **11.**  $\$73.50 \times 10$ ?  
**4.**  $315 \times 10$ ?    **8.**  $786 \times 100$ ?    **12.**  $\$684 \times 100$ ?  
**5.**  $725 \times 100$ ?    **9.**  $549 \times 100$ ?    **13.**  $\$72 \times 1000$ ?  
**14.** Multiply 64 by 2 and the product by 10.  
**15.** Multiply 73 by 3 and the product by 10.  
**16.** Multiply 85 by 5 and the product by 100.  
**17.** Multiply 91 by 50.

**91**    *Solution.* — 50 is ten times 5. 50 times 91 are the  
**50**    same as 10 times 5 times 91. 5 times 91 are 455, and  
**4550**    10 times 5 times 91 are 10 times 455, or 4550.

How many are

- 18.**  $95 \times 40$ ?    **21.**  $164 \times 20$ ?    **24.**  $31 \times 200$ ?  
**19.**  $47 \times 70$ ?    **22.**  $378 \times 70$ ?    **25.**  $64 \times 300$ ?  
**20.**  $84 \times 80$ ?    **23.**  $296 \times 60$ ?    **26.**  $93 \times 500$ ?

27.  $925 \times 30$       29.  $64 \times 300$       31.  $81 \times 700$   
 28.  $31 \times 200$       30.  $93 \times 500$       32.  $75 \times 600$   
 33. Multiply 63 by 5 and by 30, and add the products.  
 34. Multiply 42 by 6 and by 10, and add the products.  
 35. Multiply 76 by 4 and by 20, and add the products.  
 36. Multiply 84 by 72, and prove the work.

$$\begin{array}{r}
 84 \text{ Multiplicand} \dots\dots 72 \\
 72 \text{ Multiplier} \dots\dots 84 \\
 \hline
 168 \text{ 1st Partial Product, } 288 \\
 588 \text{ 2d Partial Product, } 576 \\
 \hline
 6048 \text{ Complete Product, } 6048
 \end{array}$$

*Solution.*—Multiplying by 72 is the same as multiplying by 2 and 70 and adding the products. 2 times 84 are 168 ones, and 70 times 84 are 588 tens. Add-

ing the partial products, we have 6048.

As  $84 \times 72 = 72 \times 84$  (Art. 80), to prove the work we multiply 72 by 84, and obtaining the same result as at first, we conclude that our work is correct.

Multiply	How many are	Find the product of
37. 65 by 83	42. $387 \times 42$	47. $\$8.46 \times 97$
38. 94 by 73	43. $493 \times 75$	48. $\$9.87 \times 123$
39. 61 by 95	44. $625 \times 69$	49. $\$6.49 \times 846$
40. 84 by 37	45. $841 \times 48$	50. $\$5.28 \times 927$
41. 62 by 45	46. $983 \times 54$	51. $\$837 \times 647$

52. Multiply \$423 by 405.

$$\begin{array}{r}
 \$423 \\
 405 \\
 \hline
 2115 \\
 1692 \\
 \hline
 \$171315
 \end{array}$$

*Solution.*—Multiplying by 405 is the same as multiplying by 5 and by 400, and adding the products. The product by 5 is 2115 ones, and the product by 400 is 1692 hundreds. Adding, we have as the required product, \$171315.

Find the product of

- |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|
| <b>53.</b> $643 \times 509$ | <b>58.</b> $648 \times 904$ | <b>63.</b> $847 \times 847$ |
| <b>54.</b> $745 \times 706$ | <b>59.</b> $392 \times 876$ | <b>64.</b> $629 \times 986$ |
| <b>55.</b> $893 \times 150$ | <b>60.</b> $847 \times 509$ | <b>65.</b> $684 \times 732$ |
| <b>56.</b> $647 \times 391$ | <b>61.</b> $608 \times 492$ | <b>66.</b> $859 \times 673$ |
| <b>57.</b> $892 \times 809$ | <b>62.</b> $389 \times 964$ | <b>67.</b> $864 \times 831$ |

Multiply

- |                               |                             |
|-------------------------------|-----------------------------|
| <b>68.</b> \$ 8496 by 119     | <b>73.</b> \$ 6478 by 940   |
| <b>69.</b> 3406 pounds by 208 | <b>74.</b> \$ 68397 by 8320 |
| <b>70.</b> 84729 miles by 89  | <b>75.</b> \$ 698.37 by 842 |
| <b>71.</b> 4763 days by 498   | <b>76.</b> \$ 932.21 by 85  |
| <b>72.</b> 8496 feet by 837   | <b>77.</b> \$ 648.37 by 209 |
- 78.** What will 75 acres of land cost at \$ 125 per acre ?
- 79.** If a carriage wheel turns 476 times in going a mile, how many times will it turn in going 108 miles ?
- 80.**  $83 \times 72 \times 65, - 108, + 983 = ?$
- 81.**  $194 \times 446 \times 9, - 3478, - 9228 = ?$
- 82.**  $83 \times 96 \times 105, - 943, + 1878 = ?$
- 83.** Multiply 876 by itself.
- 84.** What is the product when 849 is both multiplicand and multiplier ?
- 85.** What will 325 barrels of flour cost at \$ 9.55 per barrel ?
- 86.** 85 and 128 are the factors of what number ?
- 87.**  $648 \times \$ 78.56, - \$ 2846.84 = \text{how much} ?$

**87. ORAL EXERCISES.**

1. What will 8 books cost if one book costs \$3.
2. A piece of work is done in 7 days by 8 men. How many days will one man require?
3. If you miss 9 words every day, how many will you miss in a week?
4. James earned 8 cents a day carrying papers. How much was that per week?
5. What is my weekly milk bill if I take 2 quarts daily at 10 cents a quart?
6. What will 56 sewing-machines cost at \$100 each?
7. What will 500 barrels of flour cost at \$8 a barrel?
8. Mr. Rice bought 10 dictionaries at \$8.75 each. What did they cost?
9. What will 8 gallons of oil cost at \$0.10 a gallon?
10. Bought 8 pounds of rice at 9 cents, and 7 pounds of sugar at 10 cents. How much change shall I receive if I give the grocer three half-dollars?
11. I have 4 bags of nuts, each containing 2 bushels, worth \$3 a bushel. What are they all worth?
12. Name the factors of 48; 56; 72; 54; 36; 49; 64; 32; 28.
13. How many cents are there in \$9?
14. How many cents are there in \$14.68?
15. Jane bought 10 2-cent stamps, 20 3-cent stamps, and 15 postal cards. What did she pay for them?

**88. WRITTEN EXERCISES.**

Find the cost

1. Of 126 barrels of flour at \$5.67 a barrel.
2. Of 235 yards of carpet at \$2.17 a yard.
3. Of 925 bushels of wheat at \$1.05 a bushel.
4. Of 305 reams of paper at \$3.57 a ream.
5. Of 127 gross of pencils at \$2.95 a gross.
6. Of 217 barrels of pork at \$22.15 a barrel.
7. Of 728 pounds of cotton at \$0.14 a pound.
8. Mrs. Smith bought 18 yards of silk at \$2.37 a yard, and 16 yards of trimming at \$1.12 a yard. What was the amount of her bill?
9. Find what I paid for 17 tons of coal at \$6.50, and 9 cords of wood at \$5.42 per cord.
10. A farmer bought 160 acres of woodland at \$10.75 per acre, and sold it all for \$1800. How much did he gain?
11. At 27 cents a pound what will a turkey weighing 14 pounds cost?
12. If a freight-car will carry 14115 pounds of coal, how many pounds will 36 such cars carry?
13. A conductor runs from Boston to Lawrence and back twice a day. The distance is 26 miles. How far does he travel in 8 weeks of 6 days each?
14. A merchant bought 7 bales of cotton, each bale weighing 488 pounds, at 12 cents a pound. What was the cost?

## REVIEW.



## ORAL EXERCISES.

**89. 1.** In one inclosure a farmer has 6 sheep, in another 10, and in a third twice as many as in the first. How many sheep are there in the three inclosures?

**2.** How many are  $6 + 10 + 2 \times 6$ ?

**3.** What is the product of  $12 \times 9$ ? Of  $8 \times 12$ ?

**4.** What number added to  $6 \times 6$  will make 40?

**5.** What is three times the difference between  $4 \times 5$  and  $6 \times 5$ ?

**6.** What is the value of  $7 + 8 - 11$ ? Of  $16 + 3 - 9$ ?

**7.** How much greater is  $9 + 7$  than  $9 - 7$ ?

**8.** The minuend is 23, and the subtrahend 12. What is the difference?

9. Mr. Brown bought 9 sheep at \$4 apiece, and gave in payment a note for \$25, and the remainder in cash. How much cash did he pay?

10. Subtract twice the difference between 6 and 9 from their product.

11. A man started at 8 o'clock in the morning to walk 40 miles. He walked till noon at the rate of 4 miles an hour. How far was he then from the end of his journey?

12. A fruit-dealer bought a bunch of five dozen bananas for \$2, and sold them for 5 cents each. How much did he gain?

13. Edward Snow sells 20 papers daily. If he makes a cent on each, what are his weekly earnings?

14. What number added to  $7 \times 7$  will make  $9 \times 6$ ?

15. How many corners have 7 squares and 5 triangles?

16. I bought 4 pounds of meat at 7 cents a pound, and 3 pounds of sugar at 8 cents a pound. I gave the dealer a quarter-dollar and three dimes. What change did he give me?

17. Henry is now 17 years old. Eight years ago his sister was just twice as old as he was. How old was she?

18. Jennie earned 9 cents Monday and 5 cents every other day but Sunday for a week. She spent 12 cents for a pencil. How much had she left?

19. What are the three factors of 24? Of 48? Of 50?

**90. WRITTEN EXERCISES.**

1. Find the product of 2834 and 927.
2.  $34769 + 9436$  subtracted from  $84 \times 98720 = ?$
3. Find the sum of the numbers in Exercises 1 and 2.
4. When 947 is both multiplicand and multiplier what is the product?
5. Bought 20 tons of coal at \$7.25 a ton, and 9 cords of wood at \$4.75 a cord. What was the cost of the whole?
6. Mr. A's income is \$160 a month; his expenses are \$856 a year. How much does he save in 12 months?
7. Miss Brown bought the following articles. What was the amount of her bill? 15 yards of lace at \$1.25 a yard, 14 yards of silk at \$3.75 a yard, and 42 yards of cotton at 12 cents a yard.
8.  $476 \times 809, - 7645, + 982 = ?$
9. Sold 325 barrels of apples at \$3 a barrel and received in payment 218 cords of wood at \$2.25 a cord. How much is still due me?
10. A merchant who had in a bank \$8000, drew out at one time \$3428, and at another \$2168. He then put in \$2476. How much had he then?
11. George has \$1.35. His sister lacks \$1.42 of having 9 times as much. How much has she?
12. Bought 103 acres of land at \$238 an acre and 65 acres for twice as much an acre. What did the whole cost?



13. Mr. Parker sold his horse for \$190, his wagon for \$85, 17 tons of hay at \$25 a ton, 6 cows for \$45 apiece, and a reaper for \$125. What did he receive for all?

14. Multiply the sum of 218 and 946 by 3 times their difference.

15. Add the following: \$9.74, \$8.69, \$4.72, \$8.46, \$9.25, \$11.68, \$3.94, \$8.92, \$6.40, \$7.75.

16. Mr. Clark paid \$375 for a horse, and \$95 less for a buggy. What did he pay for both?

17. Mr. Farmer bought 64 sheep at \$3.25 each and 87 at \$4.75 each. He sold them all for \$3.85 apiece. Did he gain or lose, and how much?

18. A grocer bought a tub of butter weighing 56 pounds at 23 cents a pound, and a tub weighing 68 pounds at 19 cents a pound. Did he gain or lose by selling the whole at 21 cents a pound? and how much?

19. A merchant bought 14 bales of cloth, each bale containing 42 pieces and each piece 38 yards, at 12 cents a yard. What did the whole cost?

20. Mr. Jones owes Mrs. Smith for 13 weeks' board at \$5.75 per week, and she owes him for 26 pounds of sugar at 13 cents a pound, a barrel of flour at \$7.75, and two months' rent at \$15 per month. How shall they settle?

21. 648 people attended a concert. 31 of them had their tickets given to them. Each of the others paid 25 cents admission. The expenses were \$64.85. What were the profits?

## DIVISION.

**91. Inductive Exercises.** — 1. Three 5-cent pieces are how many cents?

2. How many 5-cent pieces in 15 cents? In 20 cents?

3. How many times can you take 3 cents from 9 cents?  $9 - 3 - 3 - 3 = ?$

4. How many 3's in 9? In 15?

5. How many times can I fill a 2-quart can from a pail holding 12 quarts of milk?

6. How many times can I fill a 4-quart can?

7. How many times 2 quarts in 12 quarts? How many 4's in 12? How many 3's?

8. A farmer filled a basket holding 3 pecks 7 times with the potatoes that he dug one afternoon. How many pecks did he dig?

9. How many times are 3 pecks contained in 21 pecks?

10. Divide 10 cents equally between 2 boys, and how much will each receive?

11. What is one of the 2 equal parts of 10 cents?

12. A man earned \$16 in 4 days. What did he earn in one day? What is one of the 4 equal parts of \$16?

13. Clara had 20 cents to spend for oranges. She bought 5. What did she pay for each?

14. What is one of the 5 equal parts of 20?

**92. Division** is finding how many times one number is contained in another ; or

It is finding one of the equal parts of a number.

**93.** The **Dividend** is the number divided.

**94.** The **Divisor** is the number by which we divide.

**95.** The **Quotient** is the result of a division.

**96.** One of the *two* equal parts of a number is **one half** of the number. One half is written  $\frac{1}{2}$ .

Thus,  $\frac{1}{2}$  of 4 apples is  $4 \text{ apples} \div 2$ , or 2 apples.

One of the *three* equal parts of a number is **one third** of the number. One third is written  $\frac{1}{3}$ .

Thus,  $\frac{1}{3}$  of 9 marbles is  $9 \text{ marbles} \div 3$ , or 3 marbles.



One of the *four* equal parts of a number is **one fourth** of the number. One fourth is written  $\frac{1}{4}$ .



Thus,  $\frac{1}{4}$  of 4 apples is one apple ;  
 $\frac{1}{4}$  of 12 apples is  $12 \text{ apples} \div 4$ , or 3 apples.

One of the *five* equal parts of a number is **one fifth** of the number. One fifth is written  $\frac{1}{5}$ .

One of the *six* equal parts of a number is **one sixth** of the number, written  $\frac{1}{6}$  ; and so on.

An *Integer* is a collection of ones.

Thus 7, 288, 1000 are integers.

**97.** The **Sign of Division**,  $\div$ , or  $:$ , means *divided by*. Thus,  $16 \div 8$ , or  $16 : 8$ , is read 16 divided by 8.

Division is also indicated by writing the divisor at the left and the dividend at the right of a curve. Thus,  $5 \overline{)35}$  is read 5 in 35.

Division is sometimes indicated by writing the dividend above and the divisor below a short horizontal line. Thus,  $\$ \overline{54}_9$  shows that \$54 is to be divided into 9 equal parts.

**98.** The **Remainder** is what is left of the dividend when it does not contain the divisor an exact number of times.

Thus,  $\$ 18 \div 4 = \$ 4$ , with a *remainder* of \$2.

1. How many times is \$5 contained in \$25?
2. What is  $\frac{1}{3}$  of 30 pounds?
3. Name the dividends in exercises 1 and 2. The divisors.

4. What is  $18 \div 9$ ?      9. What is 1 half of 10?

5. What is  $14 \div 7$ ?      10. What is 1 fourth of 16?

6. What is  $24 : 4$ ?      11. What is 1 sixth of 24?

7. What is  $\frac{1}{3}$  of \$18?      12.  $8 \overline{)32}$  how many times?

8.  $\frac{4}{9}$  is how much?      13. What is  $\frac{1}{2}$  of 15 miles?

14. What is  $\frac{1}{8}$  of \$18, and what remains?

15. How many 5-dollar bills in \$22, and how many dollars besides?

**99. ORAL EXERCISES.**

Give the quotients in the following exercises at sight:

1.  $2 \overline{)10, 16, 12, 2, 4, 14, 20, 6, 8, 18.}$

2.  $3 \overline{)27, 12, 15, 30, 21, 6, 3, 18, 24, 9.}$

3.  $4 \overline{)16, 24, 8, 4, 20, 32, 36, 28, 40, 12.}$

4.  $5 \overline{)50, 35, 40, 25, 10, 5, 15, 30, 20, 45.}$

5.  $6 \overline{)48, 18, 60, 12, 36, 24, 6, 30, 42, 54.}$

6.  $7 \overline{)35, 56, 42, 7, 14, 49, 70, 21, 28, 63.}$

7.  $8 \overline{)72, 56, 40, 8, 32, 48, 16, 80, 24, 64.}$

8.  $9 \overline{)36, 18, 54, 90, 72, 9, 63, 81, 45, 27.}$

What is

9.	10.	11.	12.	13.
$\frac{1}{5}$ of 10?	$\frac{1}{5}$ of 20?	$\frac{1}{4}$ of 4?	$\frac{1}{7}$ of 7?	$\frac{1}{8}$ of 24?
$\frac{1}{4}$ of 32?	$\frac{1}{9}$ of 81?	$\frac{1}{6}$ of 12?	$\frac{1}{4}$ of 12?	$\frac{1}{9}$ of 18?
$\frac{1}{8}$ of 72?	$\frac{1}{2}$ of 6?	$\frac{1}{8}$ of 32?	$\frac{1}{6}$ of 42?	$\frac{1}{5}$ of 25?
$\frac{1}{7}$ of 21?	$\frac{1}{5}$ of 15?	$\frac{1}{9}$ of 9?	$\frac{1}{4}$ of 20?	$\frac{1}{8}$ of 48?
$\frac{1}{3}$ of 12?	$\frac{1}{9}$ of 27?	$\frac{1}{8}$ of 21?	$\frac{1}{7}$ of 35?	$\frac{1}{2}$ of 8?
$\frac{1}{5}$ of 40?	$\frac{1}{6}$ of 48?	$\frac{1}{9}$ of 36?	$\frac{1}{9}$ of 63?	$\frac{1}{8}$ of 18?
$\frac{1}{2}$ of 18?	$\frac{1}{8}$ of 9?	$\frac{1}{8}$ of 64?	$\frac{1}{2}$ of 12?	$\frac{1}{7}$ of 49?
$\frac{1}{4}$ of 28?	$\frac{1}{8}$ of 16?	$\frac{1}{8}$ of 6?	$\frac{1}{6}$ of 30?	$\frac{1}{8}$ of 8?
$\frac{1}{8}$ of 40?	$\frac{1}{6}$ of 18?	$\frac{1}{5}$ of 30?	$\frac{1}{5}$ of 45?	$\frac{1}{9}$ of 54?
$\frac{1}{5}$ of 5?	$\frac{1}{8}$ of 56?	$\frac{1}{9}$ of 45?	$\frac{1}{7}$ of 14?	$\frac{1}{8}$ of 24?
$\frac{1}{8}$ of 15?	$\frac{1}{9}$ of 72?	$\frac{1}{6}$ of 6?	$\frac{1}{2}$ of 10?	$\frac{1}{4}$ of 24?
$\frac{1}{7}$ of 28?	$\frac{1}{2}$ of 4?	$\frac{1}{4}$ of 16?	$\frac{1}{4}$ of 36?	$\frac{1}{2}$ of 14?
$\frac{1}{6}$ of 54?	$\frac{1}{6}$ of 24?	$\frac{1}{5}$ of 35?	$\frac{1}{7}$ of 63?	$\frac{1}{6}$ of 36?
$\frac{1}{2}$ of 8?	$\frac{1}{7}$ of 42?	$\frac{1}{7}$ of 56?	$\frac{1}{8}$ of 27?	$\frac{1}{2}$ of 16?

**100. ORAL EXERCISES.**

1. Divide 21 by 2, 4, 5, 6, 8, and 9.
2. What are the quotients and the remainders when 29 is divided by 3, 4, 5, 6, 7, 8, and 9?
3. When 37 is divided by 9, 8, 7, 6, 5, 4, and 3?

Give quotients and remainders in the following:

4.	5.	6.	7.	8.
$21 \div 5$	$5 \overline{) 37}$	$41 : 6$	$9 \overline{) 43}$	$29 \div 6$
$35 \div 6$	$4 \overline{) 27}$	$62 : 7$	$6 \overline{) 28}$	$39 \div 7$
$43 \div 7$	$9 \overline{) 28}$	$64 : 9$	$4 \overline{) 15}$	$49 \div 8$
$16 \div 3$	$6 \overline{) 19}$	$48 : 5$	$8 \overline{) 47}$	$59 \div 9$
$18 \div 4$	$8 \overline{) 26}$	$31 : 6$	$9 \overline{) 35}$	$69 \div 8$

9. How many times can 6 cents be taken from 44 cents, and what will remain?
10. 45 is 5 times what number?
11. What are the factors of 24? Of 48? Of 63?
12. The dividend is 72 and the divisor is 8; what is the quotient? How many 9's in 72?

Find the value of the following:

- | 13.                   | 14.                           | 15.   | 16.         |
|-----------------------|-------------------------------|---|-------------|
| $6 \times 6, \div 9$  | $7 \times 7, + 6, \div 9$     | $\frac{1}{7}$ of 63, $+ 5 \div 2$               | $47 \div 8$ |
| $3 \times 8, \div 6$  | $36 \div 9, \times 6, \div 8$ | $\frac{1}{8}$ of 64, $\times \frac{1}{6}$ of 25 | $65 \div 9$ |
| $5 \times 6, \div 10$ | $48 \div 6, \times 3, \div 4$ | $\frac{1}{3}$ of 27, $\div 3, \times 6$         | $14 \div 5$ |
| $4 \times 6, \div 3$  | $6 \times 7, + 3, \div 9$     | $64 \div 8, \div 2, \times 9$                   | $41 \div 8$ |
- 
17. What is  $\frac{1}{2}$  of \$40?
  18.  $\frac{1}{8}$  of 81 pounds?
  19. What is  $\frac{1}{3}$  of \$.64?
  20.  $\frac{1}{4}$  of 49 hours?

**101. WRITTEN EXERCISES.****1** How many times is 6 contained in 2838 ?

Divisor, 6 ) 2838, Dividend.  
               473, Quotient.

Proof, {  $\frac{6}{2838}$ , Divisor.  
               Dividend.

*Solution.*— We write the divisor at the left of the dividend, with a curve between.

6 in 28 hundreds, 4 hundredstimes, and 4 hundreds,

or 40 tens remaining ; we write the quotient, 4 hundreds, beneath, in the hundreds place, and add the 40 tens to the 3 tens of the dividend, making 43 tens ; 6 in 43 tens, 7 tens times, and 1 ten, or 10 ones, remaining ; we write the 7 tens in tens' place in the quotient, and add the 10 ones to the 8 ones of the dividend, making 18 ones ; 6 in 18 ones, 3 times, which we write in the ones' place in the quotient. Answer, 473.

To prove the work we multiply the quotient by the divisor, as their product should always equal the dividend.

In dividing we may simply say 6 in 28, 4 ; in 43, 7 ; in 18, 3 ; quotient, 473.

Place the decimal point in the quotient under that of the dividend.

Divide

- |              |                |                |
|--------------|----------------|----------------|
| 2. 2465 by 5 | 10. 45864 by 6 | 18. 32949 by 9 |
| 3. 7632 by 6 | 11. 30009 by 7 | 19. 93726 by 6 |
| 4. 3339 by 7 | 12. 92745 by 9 | 20. 95634 by 6 |
| 5. 7464 by 8 | 13. 44737 by 7 | 21. 58037 by 7 |
| 6. 2574 by 3 | 14. 64375 by 5 | 22. 35145 by 9 |
| 7. 6975 by 5 | 15. 71296 by 8 | 23. 77756 by 4 |
| 8. 4959 by 9 | 16. 44961 by 7 | 24. 68955 by 5 |
| 9. 5873 by 7 | 17. 19372 by 4 | 25. 83664 by 9 |

**102. ORAL EXERCISES.**

1. A cow gives 56 quarts of milk in a week. How much does she give in a day?

2. Mr. Ladd paid \$63 for 7 weeks' board. What was that a week?

3. In a base-ball match a club of 9 boys made 45 runs. What was that for each player?

4. A blacksmith earned \$24 in a week. How much did he earn in one day?

5. A coach which carries 8 men at a load, took 48 men to a fair. How many trips did it make?

6. If you should divide 3 apples between two boys, what would each receive? What is  $\frac{1}{2}$  of 3?

7. If I should divide \$13 among 4 boys, how many whole dollars and what part of a dollar would each receive?

8. How do you find  $\frac{1}{4}$  of a number? What is  $\frac{1}{4}$  of 3?

*Solution.* — As 3 is less than 4, the division can only be indicated thus,  $\frac{3}{4}$ , read *three fourths*.

9. What is  $\frac{1}{4}$  of \$7? Of \$9? Of \$15?

10. What is  $\frac{1}{5}$  of 3?  $\frac{1}{5}$  of 4?  $\frac{1}{5}$  of 7?

• 11. Jane was away from home visiting 13 days, and  $\frac{1}{3}$  of the time was rainy. How many days were rainy?

12. If one of the 5 equal parts of a number is  $\frac{1}{5}$ , what will 2 of the equal parts be? 3 of the equal parts? 4 of the equal parts?



**103. WRITTEN EXERCISES.**

1. Divide 1703 by 4.

$$\begin{array}{r}
 4 \overline{) 1703} \\
 \underline{425\frac{3}{4}} \\
 \text{Proof, } \left\{ \begin{array}{r} 4 \\ \overline{1703} \end{array} \right.
 \end{array}$$

*Solution.* — Dividing, we have a final remainder of 3, the division of which we indicate by writing the divisor 4 under the 3, with a line between. The quotient,  $425\frac{3}{4}$ , is read four hundred twenty-five and three fourths.

To prove the work, we multiply the integer of the quotient by the divisor, and adding the remainder, have the dividend.

2. How many times is \$8 contained in \$1728?      3. What is  $\frac{1}{8}$  of \$17.28?

$$\begin{array}{r}
 \$8 \overline{) \$1728} \\
 \underline{216}
 \end{array}$$

$$\begin{array}{r}
 8 \overline{) \$17.28} \\
 \underline{\$2.16}
 \end{array}$$

Observe, that when the division is to show how many times one of two like numbers is contained in the other, the quotient is always *abstract*; but when we divide to find one of the equal parts of the dividend, the quotient and the dividend are *like numbers*.

What is

4.  $\frac{1}{4}$  of 98764?      7.  $\$46832 \div \$7$ ?      10.  $\frac{1}{5}$  of 42687?  
 5.  $\frac{1}{8}$  of 34976?      8.  $\$83976 \div \$6$ ?      11.  $\frac{1}{8}$  of \$64329?  
 6.  $\frac{1}{9}$  of \$42967?      9.  $\$94372 \div \$5$ ?      12.  $\frac{1}{7}$  of 34821?

Divide

13. 47609 by 6.      14. By 8.      19. 84763 by 6.      20. By 5.  
 15. 89761 by 7.      16. By 9.      21. 20931 by 7.      22. By 4.  
 17. 58067 by 8.      18. By 7.      23. 64039 by 8.      24. By 6.

**104. ORAL AND WRITTEN EXERCISES.**

1. (a)\* What is the cost of one barrel of flour when 8 barrels cost \$72? (b)† When 8 barrels cost \$74.80?

*Solution.* — (a) When 8 barrels cost \$72, 1 barrel costs  $\frac{1}{8}$  of \$72, or \$9.

8) \$74.80, cost of 8 barrels.	(b) When 8 barrels cost
\$9.35, cost of 1 barrel.	\$74.80, 1 barrel costs $\frac{1}{8}$ of
	\$74.80, or \$9.35.

2. (a) What will 1 ton of coal cost if 7 tons cost \$49? (b) If 7 tons cost \$59.92?

3. (a) What is the price of board a week when \$81 is paid for 9 weeks' board? (b) When \$94.50 is paid?

4. (a) A merchant bought 8 bales of cotton weighing 4800 pounds. What was the average weight of a bale? (b) If there had been 5976 pounds, what would a bale have weighed?

5. (a) When 6 men have \$54, what is that to a man? (b) When they have \$95634?

6. (a) Find the value of  $7 \times 6, + 9, - 6, \div 5$ . (b) Of  $36 \times 45, + 189, - 72, \div 9$ .

7. (a) For \$2.40 how many oranges may be bought at 3 cents apiece? (b) For \$457.23?

8. (a) How many cords of wood at \$4 a cord can be bought for \$40? (b) For \$18924?

9. (a) For \$54 how many pairs of shoes can be bought at \$6 a pair? (b) For \$9342?

10. (a) Divide  $9 \times 8$  by 7. (b)  $948 \times 631$  by 8.

\* Oral.

† Written.

11. (a) When 8 pounds of meat cost 72 cents, what will 9 pounds cost? (b) When 8 pounds cost \$2.32, what will 34 pounds cost?

*Solution.* (a) When 8 pounds cost 72 cents, 1 pound costs  $\frac{1}{8}$  of 72 cents, or 9 cents; when 1 pound costs 9 cents, 9 pounds cost  $9 \times 9$  cents, or 81 cents.

(b) When 8 pounds cost \$2.32, 1 pound costs  $\frac{1}{8}$  of \$2.32, or \$.29; when 1 pound costs \$.29, 34 pounds cost  $34 \times $.29$ , or \$9.86.

8)	\$2.32	cost of 8 pounds.
	\$ .29	cost of 1 pound.
	34	
	116	
	87	
	\$9.86	cost of 34 pounds.

Find the cost of

12. (a) 8 pounds of lard when 7 pounds cost \$.56.  
 (b) 25 tons of coal when 6 tons cost \$50.76.
13. (a) 8 dozen eggs if 7 dozen cost \$.70.  
 (b) 24 cows when 9 cows cost \$612.
14. (a) 5 pairs of boots if 6 pairs cost \$48.  
 (b) 217 pairs of boots if 9 pairs cost \$52.65.
15. (a) 6 lead pencils when 9 pencils cost \$.63.  
 (b) 125 gross of pencils when 8 gross cost \$34.80.
16. (a) 8 quarts of oil when 9 quarts cost \$.90.  
 (b) 429 barrels of oil when 6 barrels cost \$31.80.
17. (a) 12 peaches when 8 peaches cost 40 cents.  
 (b) 96 crates of peaches when 5 crates cost \$13.25.
18. (a) 9 horses when 4 horses cost \$480.  
 (b) 106 horses when 8 horses cost \$1904.
19. (a) 10 ounces of camphor when 5 ounces cost \$.25.  
 (b) 238 pounds of camphor when 8 pounds cost \$2.56.

**105. WRITTEN EXERCISES.**

1. Divide 8516 by 15.

$$\begin{array}{r}
 567\frac{11}{15}, \text{ Quotient.} \\
 \text{Divisor } 15 \overline{) 8516}, \text{ Dividend.} \\
 \underline{75} \\
 101 \\
 \underline{90} \\
 116 \\
 \underline{105} \\
 11, \text{ Remainder.}
 \end{array}$$

*Solution.* — 15 in 85 hundreds 5 hundreds times. We write the 5 hundreds in hundreds' place over the dividend.  $5 \text{ hundreds} \times 15 = 75$  hundreds, which, taken from 85 hundreds of the dividend, leave 10 hundreds. Uniting with

these 10 hundreds 1 ten of the dividend, we have 101 tens. 15 in 101 tens 6 tens times, which we write in the tens' place in the quotient.  $6 \text{ tens} \times 15 = 90$  tens, which, taken from 101 tens, leave 11 tens; uniting with the 11 tens the 6 ones of the dividend, we have 116 ones. 15 in 116 ones, 7 times, which we write in the ones' place of the quotient;  $7 \times 15 = 105$ , which, taken from 116, leaves 11. We indicate the division of 11 thus,  $\frac{11}{15}$ , and place it in the quotient. We have as the complete quotient  $567\frac{11}{15}$ .

When the dividend contains decimal places and the divisor does not, the point of the quotient must be placed over that of the dividend.

2. Divide 25.08 by 12.

$$\begin{array}{r}
 2.09 \\
 12 \overline{) 25.08} \\
 \underline{24} \\
 108 \\
 \underline{108} \\
 0
 \end{array}$$

In this example the second partial dividend, 10, is smaller than the divisor. Hence we place 0 in the quotient, annex another dividend figure, 8, to the partial dividend, and proceed as before

Divide

3. 2568 by 21      5. 7649 by 61      7. 9843 by 41  
 4. 3779 by 31      6. 8438 by 71      8. 7789 by 51

## Divide

- |                     |                |                  |
|---------------------|----------------|------------------|
| 9. 8642 by 32       | 17. 9807 by 62 | 25. 9483 by 92   |
| 10. 6938 by 42      | 18. 8647 by 72 | 26. 7847 by 108  |
| 11. \$ 282.66 by 42 | 19. 8271 by 63 | 27. 12931 by 104 |
| 12. \$ 446.26 by 53 | 20. 9648 by 84 | 28. 13406 by 112 |
| 13. \$ 506.88 by 64 | 21. 3782 by 73 | 29. 14291 by 125 |
| 14. \$ 813.75 by 93 | 22. 9641 by 65 | 30. 10476 by 95  |
| 15. \$ 481.50 by 75 | 23. 8394 by 74 | 31. 50312 by 411 |
| 16. \$ 948.62 by 78 | 24. 4968 by 88 | 32. 34768 by 115 |

## Divide

- |                  |                            |
|------------------|----------------------------|
| 33. 47651 by 413 | 43. $837641 \div 829 = ?$  |
| 34. 83072 by 761 | 44. $287641 \div 746 = ?$  |
| 35. 94984 by 842 | 45. $8347.68 \div 842 = ?$ |
| 36. 32555 by 305 | 46. $429841 \div 791 = ?$  |
| 37. 68075 by 768 | 47. $683400 \div 566 = ?$  |
| 38. 32078 by 943 | 48. $2004.76 \div 803 = ?$ |
| 39. 46843 by 476 | 49. $694321 \div 976 = ?$  |
| 40. 98765 by 854 | 50. $8437.61 \div 428 = ?$ |
| 41. 48347 by 329 | 51. $683974 \div 799 = ?$  |
| 42. 76921 by 758 | 52. $824681 \div 838 = ?$  |

53. The dividend is  $28 \times 914$ ; the divisor is  $3 \times 28$   
Find the quotient.

54. Divide 347688 by 8, and the quotient by 15  
 55. Divide 196 times 813 by  $\frac{1}{2}$  of 1728.  
 56.  $376 \times 42, - 813, + 641, \div 83 = ?$   
 57.  $846 + 728, \times 135, - 1098, \div 72 = ?$

**106. ORAL EXERCISES.**

1. How many ten-dollar bills will pay for \$100 worth of coal? How many 10's in 100?

2. How many are  $3 \times 10$ ?  $4 \times 10$ ?  $6 \times 10$ ?  $7 \times 10$ ?

3. Divide by 10 from 10 in 10 to 10 in 100.

What is

4.  $\frac{1}{10}$  of 60 apples?      8.  $\frac{1}{100}$  of 2500 cents?

5.  $\frac{1}{10}$  of 160 pounds?      9.  $\frac{1}{100}$  of 2800 miles?

6.  $\frac{1}{100}$  of 700 gallons?      10.  $100 \times 64$  yards?

7.  $\frac{1}{100}$  of 600 cents?      11.  $\frac{1}{100}$  of 6400 yards?

12. In \$50. what is the place-value of the 5? What is the place-value of the 5 if the point is moved to the left, thus, \$5.0? What is  $\frac{1}{10}$  of \$50?

13. What, then, is the effect of moving the decimal point in a number to the left one place?

14. Read the following: \$525.; \$5.25; \$675.; \$6.75.

15. What is  $\frac{1}{100}$  of \$525?  $\frac{1}{100}$  of \$675?  $\frac{1}{100}$  of \$865?

16. How many dimes in 100 cents? In 200 cents?

17. How many dollars in 600 cents? In 500 cents?

18. How many dollars and cents in 635 cents? In 842 cents?

19. What is the effect of moving the decimal point two places to the left?

20. Divide \$450 by 100.  $\frac{1}{100}$  of \$450 is \$4.50.

**107.** *To divide a number by 10, move the decimal point one place to the left; by 100, two places; by 1000, three places, etc.*

**21.** Divide \$1650 by 10; by 100.

*Solution.* — Moving the decimal point one place to the left gives  $\frac{1}{10}$  of \$1650, or \$165.0; moving it two places gives  $\frac{1}{100}$  of \$1650, or \$16.50.

Divide

- |                         |                          |
|-------------------------|--------------------------|
| <b>22.</b> 840 by 10    | <b>27.</b> \$8450 by 100 |
| <b>23.</b> 695 by 100   | <b>28.</b> \$6.90 by 10  |
| <b>24.</b> 2843 by 1000 | <b>29.</b> \$847 by 100  |
| <b>25.</b> 1731 by 10   | <b>30.</b> \$9476 by 100 |
| <b>26.</b> \$865 by 100 | <b>31.</b> \$2.50 by 10  |
- 32.** Change 630 cents to dollars. 890 cents.
- 33.** How many suits of clothes at \$10 a suit can be bought for \$1450? For \$8640?
- 34.** How many gold watches at \$100 each will \$94500 buy? \$5000?
- 35.** If 100 men earn \$1750 in a week, what does one man earn?
- 36.** What is  $12 \div 6$ ?  $\frac{1}{2}$  of 12?  $\frac{1}{2}$  of  $12 \div \frac{1}{2}$  of 6?
- 37.** What is  $\frac{1}{10}$  of 30?  $\frac{1}{10}$  of 60? How many times is  $\frac{1}{10}$  of 30 contained in  $\frac{1}{10}$  of 60?  $60 \div 30 = ?$
- 38.** Does  $\frac{1}{10}$  of  $60 \div \frac{1}{10}$  of 30 =  $60 \div 30$ ?
- 39.** Is the quotient changed when both dividend and divisor are divided by the same number?

**108.** *Dividing both dividend and divisor by the same number does not change the quotient.*

**109. WRITTEN EXERCISES.**

1. Divide 1280 by 80.

$$\begin{array}{r} 8 \overline{) 1280} \\ 16 \end{array}$$

*Solution.*—Since dividing both dividend and divisor by the same number does not change the quotient,  $1280 \div 80$  is the same as  $\frac{1}{10}$  of  $1280 \div \frac{1}{10}$  of 80. Dividing both dividend and divisor by 10 by marking off a cipher at the right of each, we make the dividend 128 and the divisor 8. 8 in 128, 16 times, Ans.

2.  $6510 \div 70 = ?$

5.  $\$64800 \div \$600 = ?$

3.  $5940 \div 90 = ?$

6.  $\$960 \div \$320 = ?$

4.  $28800 \div 400 = ?$

7.  $42000 \div 7000 = ?$

8. How many pianos will \$46200 buy at \$700 each?

9. If 80 carriages are sold for \$25600, what is one sold for?

10. Divide 5773 by 90.

$$\begin{array}{r} 9 \overline{) 5773} \\ 6413 \\ \hline 90 \end{array}$$

*Solution.*— $5773 \div 90$  is the same as  $5773 \div 10$ , and the result  $\div 9$ . Dividing by 10 the quotient is 577 and a remainder of 3. Dividing this quotient, 577, by 9, we have 64 as the quotient, with 1 ten as a remainder. Uniting the first remainder, 3, with the last remainder, 1 ten, we have the true remainder, 13. Hence the quotient is  $64\frac{13}{90}$ .

11.  $8479 \div 70 = ?$

16.  $86439 \div 1300 = ?$

12.  $6472 \div 80 = ?$

17.  $79421 \div 5600 = ?$

13.  $18396 \div 500 = ?$

18.  $83214 \div 600 = ?$

14.  $9777 \div 600 = ?$

19.  $64321 \div 7000 = ?$

15.  $3472 \div 900 = ?$

20.  $39768 \div 1500 = ?$



21. How many dollars and cents in  $\$846 \div 25$ ?

$\$33.84$

25)  $\$846.00$

$$\begin{array}{r} 75 \\ \underline{96} \\ 75 \\ \underline{210} \\ 200 \\ \underline{100} \\ 100 \end{array}$$

*Solution.*—Since the division is to be carried to cents we annex to the dividend two decimal orders, and then dividing we have as the quotient,  $\$33.84$ . That is, *when the dividend is dollars and the quotient is to contain cents, two decimal places of zeros must be annexed to the dividend.*

Divide, continuing the division to cents.

22.  $\$255$  by 75

25.  $\$2448$  by 96

23.  $\$240$  by 35

26.  $\$5022$  by 108

24.  $\$560$  by 64

27.  $\$204$  by 48

28. What will one book cost at  $\$45$  for a dozen?

29. Divide  $\$2764$  by 24 to mills. Ans.  $\$115.166+$

NOTE. Here, in the answer, the sign  $+$  is used to show that the division is not exact, and might have been carried farther. In business, results are taken to the nearest cent, 5 mills or more being considered another cent. Thus  $\$115.166+$  would be called  $\$115.17$ . Answers are so given in this book unless otherwise indicated.

30. Find one of the 52 equal parts of  $\$768$  to the nearest cent.

Divide to the nearest cent:

31.  $\$675$  by 84

35.  $\$37.68$  by 19

32.  $\$918$  by 98

36.  $\$84.78$  by 211

33.  $\$745$  by 121

37.  $\$984$  by 470

34.  $\$1649$  by 841

38.  $\$62.10$  by 144

**110. ORAL EXERCISES.**

1. What is 100 times \$ 2.40 divided by 10?
2. If 200 men earn \$ 600 in a day, what will 500 men earn in the same time?
3. Divide \$ 635 by 10; by 100.
4. How many cents are there in \$ 85? How many dollars are there in 875 cents?
5. How many 5-cent pieces make \$ 1?
6. How many quarter-dollars make \$ 1? \$ 5? \$ 6.25? \$ 7.75?
7. At 25 cents a quart, how many quarts of strawberries will \$ 1.25 buy?
8. How many times is 1 cent contained in \$ 1? 2 cents in \$ 2? \$.08 in \$ 8?
9. How many half-dollars in \$ 1? In \$ 5?
10. If Harry earns \$.50 in one day, in how many days will he earn \$ 3.50?
11. How many 3-cent stamps will \$ 3 buy? How many 5-cent stamps?  $\$ 3.00 \div \$ .06 = ?$
12. If a knife costs \$.80 how many boys can be supplied with knives for \$ 6.40?
13. If the fare from my home to the city is \$.60 how many tickets can I purchase with \$ 5, and how much shall I have left?
14. Divide \$.56 by \$.08.  $\$ 5.60$  by \$.80.
15. At 60 cents a pound, how many pounds of tea can be bought for \$ 3?
16. How are dollars changed to cents?

**III. WRITTEN EXERCISES.**

1. At \$.78 a bushel, how many bushels of corn can be bought for \$39?

*Solution.* — \$39 is the same as 3900 cents. 78 cents in 3900 cents 50 times. Ans. 50 bushels.

2. Paid \$17.10 for coffee at 38 cents a pound. How many pounds did I buy?

3. At \$.54 a gallon, a hogshead of molasses cost \$66.42. How many gallons did it hold?

4. How many bushels of wheat at \$2.25 a bushel can be bought for \$96.75.

*Solution.* — \$2.25 = 225 cents. \$96.75 = 9675 cents.  $9675 \text{ cents} \div 225 \text{ cents} = 43$ . Ans. 43 bushels.

How many times

- |                        |                          |
|------------------------|--------------------------|
| 5. \$6.25 in \$768.75? | 8. \$0.52 in \$162.76?   |
| 6. \$0.98 in \$210.70? | 9. \$1.13 in \$800.04?   |
| 7. \$1.32 in \$897.60? | 10. \$36.15 in \$433.80? |

I can buy how many

11. Pounds of sugar for \$17.28 at \$0.16 a pound?
12. Yards of silk for \$101.25 at \$3.75 a yard?
13. Barrels of pork for \$1365 at \$16.25 a barrel?
14. Silk umbrellas for \$534.75 at \$4.65 each?
15. Clocks for \$2100 at \$8.75 each?
16. Straw hats for \$560 at \$1.75 each?
17. Dozen spoons for \$640.64 at \$3.08 each?
18. Pounds of coffee for \$72.15 at \$0.65?
19. Jars of fruit for \$23.04 at \$0.48?

**112. ORAL AND WRITTEN EXERCISES.**

1. (a) What is the quotient when the dividend is 490 and the divisor 7 ?

(b) When the dividend is 30625 and the divisor 175 ?

2. (a) How long will it take 9 men to build a wall if 1 man can do it in 81 days ?

(b) 19 men if 1 man can do it in 361 days ?

3. (a) When the product of two numbers is 72, and one of the numbers is 9, what is the other ?

(b) When the product is 9409 and one number 97 ?

4. (a) A man earned \$1200 a year and paid one twelfth of it for rent ; what was his rent ?

(b) What would it have been if he had paid  $\frac{1}{4}$  of it ?

5. (a) How many days will it take a man to travel 120 miles at the rate of 20 miles daily ?

(b) 17064 miles at the rate of 216 miles a day ?

6. (a) Find the profit when 32 quarts of nuts are bought for \$3 and sold at 10 cents a quart.

(b) When 56 barrels of flour are bought for \$410 and sold at \$7.50 per barrel.

7. (a) What is the average weight of each boy when 7 boys weigh 560 pounds ?

(b) Of each man when 96 men weigh 20448 pounds ?

8. (a) How many weeks are there in 69 days ?

(b) How many years of 365 days each in 7665 days ?

9. (a) What will 10 eggs cost at \$.24 per dozen ?

(b) 53 sewing-machines when 24 cost \$1812 ?

10. (a) What will 12 fans cost if 7 fans cost \$.35 ?

(b) 108 boxes of soap if 96 boxes cost \$343.68 ?

Find the cost of

11. (a) 7 days' work when 6 days' work cost \$18.  
(b) 64 days' work when 27 days' work cost \$74.25.
12. (a) 8 pairs of boots when 5 pairs cost \$15.  
(b) 95 cases of shoes when 15 cases cost \$427.50.
13. (a) 5 music lessons when 3 cost \$4.50.  
(b) 24 music lessons when 11 cost \$30.25.
14. (a) 7 yards of ribbon when 10 yards cost \$.90.  
(b) 86 pieces of ribbon when 50 pieces cost \$57.
15. (a) 10 pounds of nails when 100 pounds cost \$3.  
(b) 75 kegs of nails when 85 kegs cost \$403.75.
16. (a) 7 chairs at \$84 a dozen.  
(b) 118 chairs at \$15.36 a dozen.
17. (a) 75 paper napkins at one dollar a hundred.  
(b) 25 thousand envelopes at \$2.50 for 2 thousand.
18. (a) 7 months' rent at \$240 a year.  
(b) 18 months' rent at \$297 a year.
19. (a) 8 yards of calico when 7 yards cost \$.77.  
(b) 352 yards of broadcloth when 79 yards cost \$280.45.
- / 20. (a) 6 photographs at \$3.00 a dozen.  
(b) 25 photograph albums at \$56.64 a dozen.
21. (a) 4 tons of coal when 9 tons cost \$54.  
(b) 35 tons of coal when 284 tons cost \$1846.
22. (a) 10 lemons at 36 cents a dozen.  
(b) 8 boxes of lemons when 17 boxes cost \$49.30.
23. (a) 9 sheets of paper when 7 sheets cost \$0.21.  
(b) 25 reams of paper when 13 reams cost \$50.05.

**MISCELLANEOUS.****113. ORAL EXERCISES.**

1. Learn and recite the following tables : —

**LIQUID MEASURES.**

4 gills (gi.) are 1 pint (pt.)  
 2 pints " 1 quart (qt.)  
 4 quarts " 1 gallon (gal.)

**DRY MEASURES.**

2 pints are 1 quart  
 8 quarts " 1 peck (pk.)  
 4 pecks " 1 bushel (bu.)



2. Name some things that are bought by the quart or gallon. Some sold by the bushel or peck.

3. How many quarts in 9 gallons? Pints?
4. How many gallons in 28 quarts? In 16 pints?
5. How many pecks in 7 bushels? In 24 quarts?
6. How many quarts in a bushel? In half a bushel?
7. What will 2 gal. of ice-cream cost at \$.50 a quart?

8. Bought a bushel of nuts for \$2, and sold them at 10 cents a quart. What did I gain?

9. If a horse eats a peck of oats a day, how many bushels will a span of horses eat in 6 days?

**114. WRITTEN EXERCISES.**

1. Name some articles that are sold by count. By the pound or ounce.

2. Learn and recite the following tables :—

**COUNTING.**

12 ones are 1 dozen (doz.)  
 12 dozen " 1 gross (gr.)  
 24 sheets " 1 quire (qr.)  
 20 quires " 1 ream.

**WEIGHT.**

16 ounces (oz.) are 1 pound (lb.)  
 2000 pounds " 1 ton (T.)  
 2240 pounds make a long ton and 100 pounds a hundredweight (cwt.) or cental (ctl.)

3. What will a gross of blackboard erasers cost at \$1.56 a dozen ?

4. A stationer sold one man 13 gross of lead pencils, and another man 75 dozen. How many pencils did he sell ?

5. How many sheets are there in a ream of paper ?

6. Bought a half-ream of paper for \$2 and sold it at a cent a sheet. How much did I gain ?

7. Mr. Smith has 16 hens, which lay on an average 213 eggs each a year. How many dozen do they all lay ?

8. How many ounces are there in 65 pounds ? In a ton ?

9. In a car-load of coal weighing 14856 pounds how many tons and pounds ? Long tons ?

10. Bought 35 pounds of camphor at \$.28 a pound and retailed it at 3 cents an ounce. How much did I gain ?

11. How many clothes pins are there in 125 gross ?

**115. ORAL EXERCISES.**

1. Learn and recite the following table : —

**TIME.**

60 seconds (sec.)	are 1 minute (min.)
60 minutes	" 1 hour (h.)
24 hours	" 1 day (d.)
365 days	" 1 common year (y.)

Also,

7 days	are 1 week (wk.)
12 calendar months	" 1 year.
366 days	" 1 leap year.
100 years	" 1 century.

2. How many minutes in 180 sec.? In 12 h.?
3. How many minutes in half an hour? In a quarter of an hour? In an hour and a quarter?
4. How many minutes from a quarter of twelve o'clock to half-past one?
5. If you go to bed at half-past eight and rise at six o'clock, how many hours do you sleep?
6. April, September, June, and November have each 30 days. All the other months have 31 days but February, which has 28 days, excepting in a leap year, when it has 29. Name the 7 months that have 31 days.
7. Emma's vacation began April 3d and lasted 3 weeks. On what day of the month did it end?
8. How long is the night when the sun rises at 5 o'clock and sets at 7?
9. How many years in 15 centuries?



**116. WRITTEN EXERCISES.**

1. The President's salary is \$50000 a year. How much is that a month? A day?

2. At \$14.21 a week how much can a clerk earn in 364 days?

3. A gentleman left for Europe Jan. 1, 1882, and was away just five months. How many days was he away?

4. Edward is 12 years 86 days old. How many days has he lived, counting 3 leap years.

5. How many hours are there in December?

6. How many years and days are there in 20000 days?

7. When the number of a year can be exactly divided by 4, the year is a leap year. Centennial years not divisible by 400 are exceptions. Which of the following are leap years: 1776? 1882? 1892? 1900?

8. A carpenter earned \$2.75 a day every day in the year 1880, excepting 52 Sundays and 4 holidays. How much did he earn?

9. A man smokes three 5-cent cigars daily for 15 years. Counting 4 leap years, how much money does he waste?

10. If your heart beats 70 times a minute, how many times does it beat in an hour? In a day? In a common year?

11. If a railroad train averages 24 miles an hour, in how many days will it run 5184 miles?

## REVIEW.

## 117. ORAL EXERCISES.

1. How many times  $7 + 2$  in  $64 + 8$ ?
2. Subtract  $7 \times 7$  from  $9 \times 6$ .  $2 \times 8$  from  $3 \times 9$ .
3. Subtract the sum of 7 and 8 from their product.
4. Divide the sum of 18 and 27 by their difference.
5. How many times  $\frac{1}{2}$  of 16 in  $6 \times 4$ ? In  $\frac{1}{6}$  of 40?
6. Three parts of 54 are 20, 15, and 10. What is the other part?
7. James, John, and Edwin hire a sail boat for \$2. James pays \$.75 and Edwin \$.85. What does John pay?
8. The product of two numbers is 5600. One of them is 70. What is the other?
9. What number added to 7 times 5 will make  $\frac{1}{10}$  of 540?
10.  $500 \div 10, - 10, + 9, \div 7, \times 8, + 4, \times 10 = ?$
11. A boy earned 49 cents and his father gave him 11 more. He spent his money for doves at \$.15 each; how many did he buy?
12. The divisor is 7, the quotient 8, and the remainder 6. What is the dividend?
13. What will 5 bushels of potatoes cost at a quarter of a dollar a peck?
14. A man bought a basket of grapes, weighing 8 pounds, at the rate of 3 pounds for 15 cents. What did he pay for them?

**118. WRITTEN EXERCISES.**

1. How many times  $27 + 36$  in  $1728 + 512$ ?
2. Take  $27 \times 942$  from  $65 \times 876$ .
3. Subtract the sum of 248 and 356 from their product.
4. Divide the sum of 1947 and 1892 by their difference.
5. How many times  $\frac{1}{8}$  of 1296 in  $144 \times 608$ ?
6. The sum of five numbers is 14573; four of the numbers are 276, 849, 382, 999. What is the fifth?
7. Three men make \$1476.82 in business. The first has \$396.84, the second \$722.98, and the third the rest. How much has he?
8. In a cornfield there are 5760 hills of corn with 96 hills in a row. How many rows are there?
9. What number added to 64 times 72 will make  $\frac{1}{8}$  of 172800?
10.  $427 \times 8, - 16, \div 170, \times 1190, + 792, \div 19 = ?$
11. A merchant received \$357.06 from one of his debtors and \$842.94 from another. With the money he bought cloth at \$1.25 a yard. How many yards did he buy?
12. The divisor is 84, the quotient 108, and the remainder 69. Find the dividend.
13. What will 156 bushels of potatoes cost at \$1.65 per bushel?
14. A farmer sold his crop of apples for \$200. For 20 barrels he received \$2.50 a barrel, and for the remainder \$3 per barrel. How many barrels did he sell?

## ORAL EXERCISES.

**119.** A *parenthesis* ( ), or *vinculum*, —, is used to include such numbers as are to be considered together. Thus,  $9 \times 3 + 6 = 33$ ; but  $9 \times (3 + 6) = 81$ .  $24 \div 6 + 2 = 6$ , but  $24 \div \overline{6 + 2} = 3$ .

**NOTE.** Operations indicated by the signs  $\times$  and  $\div$  must always be performed before those indicated by  $+$  and  $-$ , unless directions are given to the contrary. (See Note, Art. 84.)

1.  $18 \div 6 + 3 = ?$
2.  $18 \div (6 + 3) = ?$
3.  $8 \times 6 - 36 \div 12 = ?$
4.  $8 \times (36 - 6) \div 12 = ?$
5.  $6 + 8 \div 2 + 5 = ?$
6.  $(6 + 8) \div (2 + 5) = ?$
7.  $(8 + 6 \times 12) \div 10 = ?$
8.  $(12 \times 6 - 4 \times 8) \div 4 = ?$
9.  $(8 \times 3 + 3 \times 10) \div 9 = ?$
10.  $(42 - 20 + 38) \div (3 \times 4) = ?$

**11.** Mary bought 7 lbs. of rice at 9 cents a pound, a dozen eggs for \$.25, and a paper of pins for \$.12. How much change should she receive if she gives the store-keeper a two-dollar bill?

**12.** When 4 quarts of vinegar can be bought for \$.28 how many quarts can be bought for \$.84?

**13.** If a train runs 75 miles in 5 hours, how long will it require to run 90 miles?

**14.** What will a gross of buttons cost at 9 cents a dozen?

**15.** Twenty men are employed in a certain factory, and 4 times as many women lacking 7. How many persons are employed in all?

**120. WRITTEN EXERCISES.**

Find the value of

1.  $1728 \div 36 + 12$       3.  $1296 \div (18 + 3 \times 7)$

2.  $1728 \div (36 + 12)$       4.  $67 + 84 \times 91 - 213$

5.  $\$467 \times \overline{141 - 132} \div 84$

6.  $8448 \div (64 - 7 \times 6) + 347$

7.  $(96 \div 8) \times (8347 - 2176)$

8.  $649 \times 0 + 84769 \div 153$

9. Mr. Stone bought 180 tons of coal at \$5.50 and 26 cords of wood at \$6.25, and paid 218 bushels of wheat valued at \$1.18 a bushel and cash to balance. How much cash did he pay?

10. When 160 acres of land can be bought for \$11200, how many acres can be bought for \$21154?

11. If a steamer sails 1425 miles in five days, how long will she be in sailing 3705 miles?

12. What will 25 bushels of chestnuts sell for at \$.12 a quart?

13. I sold a horse for \$135 and a house for 17 times as much, lacking \$185. What did I receive for both?

14. A stove-dealer sold \$1260 worth of stoves in a week, and gained \$324. If he gained \$9 dollars on a stove, how much did each stove cost him?

15. If a steamer sails 15 miles in an hour, in how many days will she sail 2160 miles?

16. If a train runs 432 miles in 12 hours, in how many hours will it run 576 miles?

**121. ORAL EXERCISES.**

1. Ella was sent to the store with \$2 to get 2 pounds of 40-cent coffee and a pound and a half of 60-cent tea. How much change did she bring back ?

2. When Frank Winslow was sick the doctor charged \$2 a visit and came to see him every day for a week, every other day during June, and once a week for the next 6 weeks. What was his bill ?

3. What is my laundry bill if I have 16 pieces washed at \$.60 a dozen ?

4. At 8 o'clock the thermometer is 58°, and at noon 87°. How many degrees has it risen ?

5. During a sudden change of weather the mercury fell from 37° above to 19° below zero. How many degrees did it fall ?

6. Carrie Davis takes the "St. Nicholas" at \$3.00 a year, the "Wide Awake" at \$2.50, and the "Young People" at \$1.50. How much does she pay a month ?

7. The tickets between two stations 5 miles apart are 8 for \$.40. What is that a mile ?

8. What is my weekly milk-bill when I take a quart in the morning and a pint at night, the price being 8 cents a quart ?

9. What will 17 quires of paper cost at \$4 a ream ?

10. What is 10 times \$5.60 divided by 100 ?

11. How many 8-gallon cans will be needed to hold 72 gallons of milk ?

12. If you have 20 minutes of recess 6 times a week, how many hours of recess do you have in a week ?

**122. WRITTEN EXERCISES.**

1. Bought a gross of collars for 25 cents a dozen, and sold them at an advance of \$.10 a dozen. What did I get for the lot ?

2. Dr. Jones bought a sirloin roast for 32 cents a pound, and a peck of peas for \$.45. How many pounds of meat did he buy if his bill was \$3.33 ?

3. There are 24 trains running daily to a summer resort. Each train has 10 passenger cars, and each car carries on the average 70 passengers. How many people visit the resort daily ?

4. If 75 feet of garden hose cost \$ 11.25, what will 125 feet cost ?

5. Gave \$ 3375 and 5 horses each worth \$ 125 for a farm of 160 acres and a house worth \$ 1200. What was the cost of the land per acre ?

6. Using the numbers 13 and 312 show how division and multiplication prove each other.

7. How many days must a man work at \$ 2.65 a day to earn \$ 299.45 ?

8. Divide \$ 1000 equally among 49 children. What will each have to the nearest cent ?

9. Find the sum of all the like numbers in exercises 1, 2, 4, 5, and 7 on this page.

10. What will 1750 pounds of coal cost at \$ 12 a ton ?

11. A barrel of flour weighs 196 pounds, and a barrel of pork 200 pounds. How many pounds do a span of horses draw if their load consists of 6 barrels of flour and 8 of pork, and the wagon weighs 1200 pounds ?

**123. ORAL EXERCISES.**

1. Annie bought a Christmas card for her father for \$.25, one for her mother for \$.35, 3 for her brothers at \$.10 each, and 2 for her sisters for \$.40. How much did she spend?

2. If 2 apples cost 3 cents, how many can you buy for 6 cents? For 12 cents? For 30 cents?

3. What will 8 photographs cost at \$3.00 a dozen?

4. How many weeks are there from June 10 to July 8?

5. How many hours does your school keep in a week?

6. How many hours from 5 o'clock A. M. to 3 P. M.?

7. Was 1824 a leap year? 1850? 1800?

8. Charles bought a bunch of 84 bananas for \$2.50 and sold them at the rate of 7 for a quarter. How much did he gain?

9. How many weeks are there in May and June?

10. If a boy sells 8 quarts of peanuts a day, how many bushels will he sell in 8 days?

11. A grocer bought \$1.60 worth of strawberries at \$.20 a box, and sold 5 boxes; how many had he left?

12. If 6 men can build a wall in 12 days, how many men can build it in 8 days?

13. What will 2 quarts of oysters cost at \$2 a gallon?

14. George buys a dozen apples at the rate of 3 for 4 cents, and sells them all for 20 cents. How much does he gain?



**124. WRITTEN EXERCISES.**

( 1. Bought a farm containing 40 acres of meadow and 17 of woodland, for \$ 2850. Sold to one man 10 acres of woodland for \$ 85 per acre, to another a house lot of 1 acre for \$ 90, and the remainder to a third for \$ 2050. What did I gain per acre by the operation ?

2. A drover with \$ 2144 bought as many horses as possible for \$ 165 each, and spent the remainder for sheep at \$ 4 a head. How many of each did he buy ?

3. A school uses 25 crayons a day. How many gross will it use in 40 weeks, provided there is no school on Saturday ?

4. How many times 945 will make 23625 ?

5. How many 5-cent pieces in a bag of them worth \$ 25 ? )

6. A clerk has a salary of \$ 42 a month, and his expenses are \$ 27 a month. How many years will it take him to lay up \$ 900 ?

7. 20 men built a school-house in 56 days. In how many days would 70 men have built it ?

8. A butcher sold a quarter of beef weighing 285 pounds for \$ 62.70 at a gain of 3 cents a pound. What did a pound cost him ?

9. Find the difference between the sum and the product of 185 and 1314.

10. Find the cost of 267 yards of cotton at \$ 0.12 a yard, and twice as much at \$ 0.14 a yard ?

11. How many pounds of tea at \$ 0.67 a pound can be bought for \$ 122.61 ?

## ACCOUNTS AND BILLS.

**125.** An **Account** is a record of articles bought or sold, cash paid or received, or services rendered.

**126.** A **Debtor** (Dr.) is one who owes a debt, and a **Creditor** (Cr.) is one to whom the debt is due.

**127.** A **Bill** is a written statement of an account made out by the creditor for the debtor.

**128.** A bill is **Receipted** when its payment is acknowledged in writing by the creditor, or by some one authorized to sign for him.

NOTE. M. stands for "thousand" and @ for at. @ is always followed by the price of one article. Thus, 5 lbs. @ \$.26 means at \$.26 a pound.

**129. WRITTEN EXERCISES.**

Copy and find the amounts due on the following accounts and bills.

1.

*William Sears,*

1882. In Account with ARTHUR PETERSON, Dr.

<i>July 2</i>	<i>To 1 bbl. Oil, 31 gal.</i>	<i>@ 63¢</i>	<i>\$</i>	
<i>" "</i>	<i>" 1 bbl. Sugar, 330 lb.</i>	<i>" 9¢</i>		
<i>July 7</i>	<i>" 50 lb. Java Coffee</i>	<i>" 24¢</i>		
<i>" "</i>	<i>" 1 box Tea, 45 lb.</i>	<i>" 43¢</i>		
	<i>Amount due .....</i>		<i>\$</i>	

2.

*Alfred Thomas,*

1882.

In Account with JAMES LAKEMAN, Br.

<i>June 6</i>	<i>To 6 Days' Work @ \$2.50</i>	<i>\$</i>	
<i>" 13</i>	<i>" 15 M. Shingles " 3.75</i>		
<i>" 14</i>	<i>" 7 Days' Labor " 3.50</i>		
<i>July 11</i>	<i>" 8 M. Lumber " 31.25</i>		
<i>" 18</i>	<i>" Job Work on House.....</i>	<i>250</i>	
	<i>Amount due.....</i>	<i>\$</i>	

3.

Boston, Aug. 10, 1882.

*Mr. James Harlow,*

TERMS, NET CASH.

Bought of WILLIAM DUTTON.

<i>1 hhd. Molasses, 120 gal. @ 50¢</i>	<i>\$</i>	
<i>125 lb. Carolina Rice " 9¢</i>		
<i>2 chests Tea, 35 lb. each " 45¢</i>		
<i>25 lb. Nutmegs " 95¢</i>		

Received Payment,

*William Dutton,**By Edward Grant.*

4.

Albany, Sept. 1, 1882.

Messrs. Russell, Low &amp; Co.

1882.

Bought of MARSTON &amp; SON.

July 1	656 yds. Sheetting @ 9¢	\$	
" 15	116 " Cassimere " \$1.25		
Cr.			
Aug. 12	By Goods returned \$103.50		
" 19	" Cash..... 25.00		
	Balance due.....	\$	

Paid,

Marston &amp; Son.

5. Make out and receipt Samuel Hatch's milk bill against A. F. Stuart for August, 1882. He took 2 quarts daily. The price was 7 cents.

6. Imagine yourself keeping a book-store. Your teacher buys of you 13 copies of this arithmetic, at \$.40; 15 copies of the geography you use, at \$.65; a box of Gillott's pens, at \$1.25; and 15 quires of paper, at \$3.60 a ream. Make out and receipt her bill.

7. Dr. A. T. White made your father 12 visits, at \$2 each, and furnished \$2.75 worth of medicine. He owed your father for 9 bushels of apples, at \$.75 each. Make out the account and receipt it.

8. Make out George Hill's bill against Wm. Aiken for 2 months' rent of house at \$400 per year.

9. The following business transactions took place between David Hall, blacksmith, and Henry Smith, farmer. Make out the bill for Mr. Hall and receipt it. May 14, 1882, he shod 3 horses at \$ 3.75 each; June 11, he repaired mowing machine, \$4.00; July 9, he charged him for 3 days' labor at \$2.25; Nov. 28 he sold him a sleigh for \$40. May 19, Mr. Smith sold Mr. Hall 25 bushels of potatoes at \$.65; June 1, 75 pounds maple sugar at \$.12; and he paid him \$10 cash July 5.

10. Suppose yourself in the wood and coal business. Make out a bill to the chairman of the school committee for 10 tons of coal at \$6.25, and 5 feet of wood at \$1.25. You charge \$.25 a ton for housing the coal, and \$.75 a foot for sawing and splitting the wood. Receipt your bill.

11. James Shaw, a mason, did the following for Henry Grant. He furnished 7 thousand bricks at \$16; 4 barrels of lime at \$1.25; 2 loads of sand at \$.75. He worked four days himself at \$3.00, and furnished a helper 3 days at \$1.75. Make out his bill.

12. How shall I settle my account with Jordan, Marsh & Co.? I owe them for 48 yards of carpet at \$1.75, 34 yards dress goods at \$1.37, and 3 children's suits at \$7.50. I have already paid them \$27.75 on account.

13. Imagine yourself keeping a grocer's store. J. H. Butler buys of you some sugar, tea, eggs, and potatoes. Make out and receipt his bill.

**130. REVIEW QUESTIONS.**

**Art. 2.** What is a number? **4.** A figure? **19.** A decimal?  
**30.** What are like numbers? How many numbers are there?  
**5.** How many different figures? **25.** Name the fifth order of units. **86.** What effect has moving the decimal point one place to the right? **107.** To the left?

**31.** What is addition? **72.** Multiplication? Show that they are alike. **53.** What is subtraction? **92.** Division? Show that they are alike. p. 25. Name the terms used in subtraction. **60.** How do you prove subtraction? **31.** What kind of numbers can be added and subtracted? p. 39. Name the terms used in multiplication. **73.** Define multiplicand. **80.** What is always the denomination of the product?

**93.** Define dividend. **103.** Illustrate the two kinds of division by examples. **101.** How do you prove division? **107.** How do you divide by 10 or 100? **111.** When we want to divide one sum of money by another, what must we do first? **101, 105.** Where do you put the decimal point in the quotient?

**113.** Give the table of dry measures. **114.** Of counting. **115.** Of time. **115.** Ex. 6. Name the calendar months and the number of days in each. **116.** Ex. 7. How do you tell when any year is a leap year? **96.** What is an integer?

**127.** What is a bill? **126.** Who pays a bill, the debtor, or the creditor? Who is debtor and who creditor in exercise 4, page 88? **128.** How would you receipt a bill for another person?

**45.** How many and what decimal places do cents, when written in figures, occupy? What decimal places do mills, when written in figures, occupy?

**101.** What terms in division correspond to the multiplier and multiplicand in multiplication? What term in division to the product in multiplication? How then would you infer that multiplication can be proved?

**119.** What is the parenthesis, or vinculum, used to include?

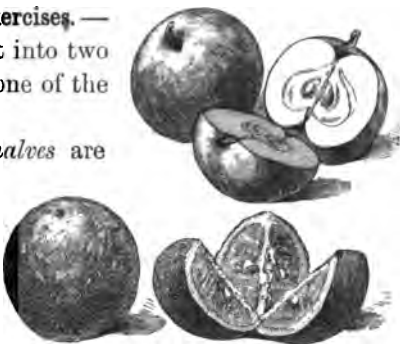
## FRACTIONS.

**131. Inductive Exercises.** —

1. If an apple is cut into two *equal parts*, what is one of the parts called ?

2. How many *halves* are there in one apple ?

3. If an orange is cut into three *equal parts*, what is one of the parts called ?



4. If I take 2 of the 3 *equal parts* of an orange, how much of the orange have I ?

5. How many *thirds* in an orange ?

6. Which is larger, *one half* of an apple, or *one third* of an apple ?

7. If a dollar is divided equally among 4 girls, what part of the dollar will each one have ?

8. Into how many *fourths* may a unit be divided ? Into how many *fifths* ?

9. What are 2 of the 4 *equal parts* of a dollar called ? 3 of the 5 *equal parts* ?

10. What do you mean when you speak of 1 *sixth* of a foot ? 5 *sixths* of it ?

11. What do you call 1 of the 8 *equal parts* of a pound ? 2 of the 8 *equal parts* ? 7 of the 8 *equal parts* ?

132. A **Fraction** is one or more of the equal parts of a unit.

133. **Common Fractions** are written in figures as follows, —

One half	is written	$\frac{1}{2}$	One seventh	is written	$\frac{1}{7}$
One third	"	$\frac{1}{3}$	Six sevenths	"	$\frac{6}{7}$
Two thirds	"	$\frac{2}{3}$	Three eighths	"	$\frac{3}{8}$
One fourth	"	$\frac{1}{4}$	Five tenths	"	$\frac{5}{10}$
Three fourths	"	$\frac{3}{4}$	Seven twelfths	"	$\frac{7}{12}$
One fifth	"	$\frac{1}{5}$	Five twenty-firsts	"	$\frac{5}{21}$
Four fifths	"	$\frac{4}{5}$	Ten forty-seconds	"	$\frac{10}{42}$

134. The **Terms** of a fraction are the two numbers used to express it.

135. The **Denominator** is the term that *names* the parts and shows their *size* by telling into how many equal parts the unit is divided. It is written below the line. Thus, 4 is the *denominator* of  $\frac{3}{4}$ .

136. The **Numerator** is the term that shows *how many* of the equal parts of the unit are expressed by the fraction. It is written above the line. Thus, 4 is the *numerator* of  $\frac{4}{5}$ .

137. A **Proper Fraction** is a fraction whose numerator is less than its denominator. As  $\frac{5}{8}$ ,  $\frac{3}{9}$ ,  $\frac{9}{10}$ .

138. An **Improper Fraction** is a fraction whose numerator is not less than its denominator. As  $\frac{5}{5}$ ,  $\frac{10}{9}$ ,  $\frac{15}{2}$ .



**139.** An **Integer** may be expressed in a fractional form by writing 1 under it for a denominator. Thus, 2 may be written  $\frac{2}{1}$ , read 2 ones.

**140.** A **Mixed Number** is an integer and a fraction united. As  $4\frac{5}{8}$ , read four and five eighths.

**141.** A *Fraction* may be regarded as an *indicated division* (Art. 97), the numerator being the dividend, and the denominator the divisor.

Hence

**142.** The **Value of a Fraction** is the quotient of the numerator divided by the denominator. Thus,  $\$ \frac{3}{4}$  is  $\frac{3}{4}$  of \$1, or  $\frac{1}{4}$  of \$3. Each equals 75 cents.

16,  $\frac{4}{5}$ ,  $\frac{8}{7}$ ,  $6\frac{1}{2}$ ,  $\frac{10}{10}$ ,  $\frac{9}{15}$ ,  $\frac{3}{1}$ ,  $7\frac{1}{4}$ ,  $\frac{11}{12}$ .

Of the above which are

1. Proper fractions?
  2. Improper fractions?
  3. Integers?
  4. Mixed numbers?
  5. The denominators?
  6. Name the numerators.
  7. What does the 5 show?
  8. What does the 12 show?
  9. What does the 9 show?
  10. What does the 4 show?
  11. Which denominator shows the largest equal part?
- The smallest?

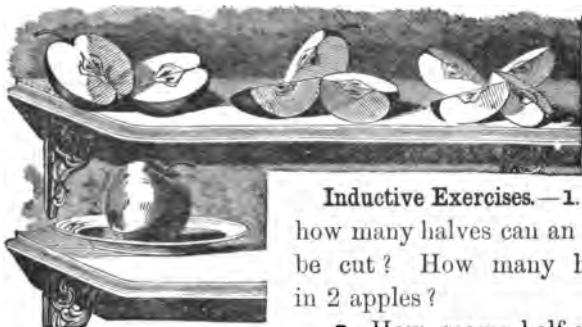
12. Name a fraction which represents seven of the eight equal parts of a dollar.

13. Tell what is shown by each term of the fraction  $\frac{9}{10}$ .

## REDUCTION OF FRACTIONS.

**143. Reduction of Fractions** is changing their form without changing their value.

**144. To change Integers and Mixed Numbers to Fractions.**



**Inductive Exercises.—1.** Into how many halves can an apple be cut? How many halves in 2 apples?

**2.** How many half-apples in  $1\frac{1}{2}$  apples? In  $2\frac{1}{2}$  apples?

**3.** Into how many thirds can an apple be divided? How many thirds in  $1\frac{1}{3}$  apples? In  $1\frac{2}{3}$  apples? In 3 apples?

**4.** Into how many fourths can an apple be divided? How many fourths in 2 apples? In  $2\frac{1}{4}$ ? In  $3\frac{3}{4}$ ?

How many

**5.** Halves in 2?

**6.** Thirds in 2?

**7.** Fourths in 3?

**8.** Fourths in 4?

**9.** Fifths in 1 orange?

**10.** Fifths in 2 oranges?

**11.** Sixths in 1 foot?

**12.** Eighths in 2 pounds?

**13.** Eighths in  $2\frac{1}{8}$  pounds?

**14.** Eighths in  $3\frac{3}{8}$  pounds?

**15.** Thirds in  $4\frac{2}{3}$ ?

**16.** Ninths in  $3\frac{1}{9}$  yards?

**17.** Tenths in  $\$4\frac{3}{10}$ ?

**18.** Change 8 to thirds.

**145. ORAL AND WRITTEN EXERCISES.**

1. (a) In 4 how many fourths? (b) In  $6\frac{3}{4}$ ? (c) In  $29\frac{3}{4}$ ?

*Solution.* — (a) In 1 there are 4 fourths; in 4 there are 4 times 4 fourths, or 16 fourths.

(b) In 1 there are  $\frac{4}{4}$ ; in 6 there are 6 times  $\frac{4}{4}$ , or  $\frac{24}{4}$ ;  $\frac{24}{4}$  and  $\frac{3}{4}$  are  $\frac{27}{4}$ . Hence  $6\frac{3}{4} = \frac{27}{4}$ .

$$\begin{array}{r} 29\frac{3}{4} \\ 4 \overline{) 116} \\ \underline{116} \phantom{00} \\ 0 \phantom{00} \end{array} \quad \frac{3}{4} = \frac{119}{4}, \text{ Ans.}$$

(c) In 1 there are  $\frac{4}{4}$ ; in 29 there are 29 times  $\frac{4}{4}$ , or  $\frac{116}{4}$ ;  $\frac{116}{4}$  plus  $\frac{3}{4}$  are  $\frac{119}{4}$ . Hence  $29\frac{3}{4} = \frac{119}{4}$ .

To change an integer or a mixed number to an improper fraction, —

*Multiply the integer by the denominator; if there is a fractional part, add its numerator to the product, and under the result place the denominator.*

Change the following to improper fractions.

ORAL.			WRITTEN.		
2.	$2\frac{1}{2}$	13.	$9\frac{2}{7}$	24.	$19\frac{5}{8}$
3.	$3\frac{2}{3}$	14.	$3\frac{2}{3}$	25.	$28\frac{3}{7}$
4.	$4\frac{2}{5}$	15.	$8\frac{5}{9}$	26.	$216\frac{3}{4}$
5.	$6\frac{5}{7}$	16.	$7\frac{7}{10}$	27.	$128\frac{1}{5}$
6.	$4\frac{5}{9}$	17.	$4\frac{5}{11}$	28.	$79\frac{5}{12}$
7.	$5\frac{4}{5}$	18.	$6\frac{7}{8}$	29.	$84\frac{3}{16}$
8.	$7\frac{2}{3}$	19.	$14\frac{7}{10}$	30.	$72\frac{7}{10}$
9.	$9\frac{5}{8}$	20.	$16\frac{15}{100}$	31.	$167\frac{4}{11}$
10.	$7\frac{6}{9}$	21.	$7\frac{3}{100}$	32.	$218\frac{3}{8}$
11.	$8\frac{3}{8}$	22.	$16\frac{9}{10}$	33.	$798\frac{5}{9}$
12.	$10\frac{5}{6}$	23.	$11\frac{4}{5}$	34.	$84\frac{13}{14}$
				35.	$44\frac{6}{7}$
				36.	$89\frac{5}{16}$
				37.	$34\frac{1}{9}$
				38.	$86\frac{14}{16}$
				39.	$73\frac{9}{16}$
				40.	$641\frac{2}{25}$
				41.	$727\frac{3}{5}$
				42.	$649\frac{2}{9}$
				43.	$843\frac{7}{8}$
				44.	$967\frac{23}{24}$
				45.	$761\frac{1}{8}$

**146. To change Improper Fractions to Integers or Mixed Numbers.****ORAL AND WRITTEN EXERCISES.**

1. How many apples in 2 halves of an apple? In 3 thirds? In 4 fourths? In 6 thirds? In 8 fourths?

2. (a) In 19 fourths how many ones? (b) In 495 fourths?

*Solution.* — (a) As 4 fourths are one, 19 fourths are as many ones as there are 4's in 19, or  $4\frac{3}{4}$ .

(b) As  $\frac{1}{4}$  are one,  $\frac{495}{4}$  are as many ones as there are 4's in 495.  $495 \div 4 = 123\frac{3}{4}$ ,  
 $4 \overline{) 495}$   
 $123\frac{3}{4}$ , Ans.      Ans.

To change an improper fraction to an integer or mixed number, —

*Divide the numerator by the denominator.*

Change the following improper fractions to integers or mixed numbers.

**ORAL.**

3. $\frac{11}{3}$	14. $\frac{53}{9}$
4. $\frac{13}{4}$	15. $\frac{52}{8}$
5. $\frac{17}{6}$	16. $\frac{61}{7}$
6. $\frac{12}{6}$	17. $\frac{67}{8}$
7. $\frac{23}{4}$	18. $\frac{71}{9}$
8. $\frac{22}{7}$	19. $\frac{73}{7}$
9. $\frac{31}{6}$	20. $\frac{72}{8}$
10. $\frac{37}{6}$	21. $\frac{83}{9}$
11. $\frac{41}{7}$	22. $\frac{82}{10}$
12. $\frac{43}{8}$	23. $\frac{243}{100}$
13. $\frac{47}{6}$	24. $\frac{56}{9}$

**WRITTEN.**

25. $\frac{883}{7}$	36. $\frac{271}{9}$	47. $\frac{1002}{16}$
26. $\frac{421}{6}$	37. $\frac{222}{16}$	48. $\frac{1352}{85}$
27. $\frac{732}{9}$	38. $\frac{233}{14}$	49. $\frac{1682}{18}$
28. $\frac{383}{12}$	39. $\frac{761}{22}$	50. $\frac{1245}{24}$
29. $\frac{412}{15}$	40. $\frac{541}{31}$	51. $\frac{6431}{32}$
30. $\frac{927}{16}$	41. $\frac{967}{25}$	52. $\frac{7846}{36}$
31. $\frac{607}{13}$	42. $\frac{222}{18}$	53. $\frac{2387}{48}$
32. $\frac{832}{18}$	43. $\frac{311}{9}$	54. $\frac{6432}{64}$
33. $\frac{237}{20}$	44. $\frac{833}{7}$	55. $\frac{2476}{126}$
34. $\frac{673}{24}$	45. $\frac{674}{13}$	56. $\frac{843}{144}$
35. $\frac{467}{21}$	46. $\frac{311}{19}$	57. $\frac{47}{181}$

**147. To change Fractions to their Smallest Terms.**

**Inductive Exercises.** — 1. What number exactly divides both 6 and 8?

2. Name a number that divides 12 and 15 exactly.
3. What three numbers divide 16 and 24 exactly?
4. What is the *greatest* number that divides them exactly?

**148.** A **Common Divisor** of two numbers is any number that exactly divides them both, and the **Greatest Common Divisor** is the greatest number that exactly divides them both. Thus,

2, 3, 4, 6, and 12 are *common divisors* of 36 and 24, and 12 is their *greatest common divisor*.

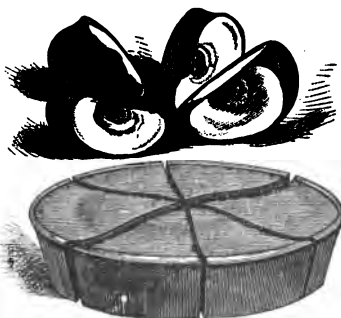
**149.** A fraction is in its **Smallest Terms** when its terms have no common divisor.

5. In  $\frac{2}{4}$  of an apple how many halves?  $\frac{2}{4}$ , then, is the same as what?

6. Which is larger,  $\frac{2}{6}$  of a cake, or  $\frac{1}{2}$  of a cake? Does  $\frac{2}{6} = \frac{1}{2}$ ?

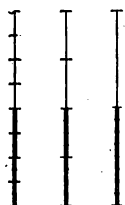
7. How many times  $\frac{2}{6}$  of a cake in  $\frac{2}{6}$  of it? In  $\frac{2}{6}$  of a cake how many thirds?

8. In  $\frac{4}{6}$  of a cake how many thirds? Which is larger,  $\frac{2}{6}$  of a cake, or  $\frac{1}{3}$  of it?  $\frac{4}{6}$  or  $\frac{2}{3}$ ?



9. Which has the larger *terms*,  $\frac{2}{3}$  or  $\frac{4}{5}$ ?
10. By what would you divide each term of  $\frac{4}{5}$  to change it to  $\frac{2}{3}$ ?
11. What part of a dollar is one dime? Fifty cents?
12. Which would you prefer,  $\frac{5}{10}$  of a dollar, or  $\frac{1}{2}$  of a dollar? Why?
13. How would you change  $\frac{5}{10}$  to  $\frac{1}{2}$ ?
14. Which term of the fraction shows the *size* of the equal parts? Which shows their *number*?
15. Of the two fractions,  $\frac{5}{10}$  and  $\frac{1}{2}$ , which expresses the larger equal parts? Which the greater number?
16. Change  $\frac{4}{8}$  to smallest terms.

ILLUSTRATION.



$$\frac{1}{8} = \frac{2}{4} = \frac{1}{2}$$

*Solution.* — Dividing both terms of  $\frac{4}{8}$  by 2, we have  $\frac{2}{4}$ ; and dividing both terms of  $\frac{2}{4}$  by 2, we have  $\frac{1}{2}$ : hence  $\frac{4}{8}$  changed to smallest terms is  $\frac{1}{2}$ .

It will be seen from the illustration that  $\frac{1}{8}$ ,  $\frac{2}{4}$ , and  $\frac{1}{2}$  have the same value, the division of both terms making the *size* of the equal parts *larger*, while it makes their *number smaller*.

**150.** *Dividing both terms of a fraction by the same number does not change its value.*

17. Change  $\frac{105}{120}$  to smallest terms.

$$\begin{array}{l} 5 \overline{) 105} \quad 3 \overline{) 21} = \frac{7}{8}, \text{ Ans.} \\ 5 \overline{) 120} = 3 \overline{) 24} \end{array}$$

*Solution.* — Dividing both terms of the given fraction by their common divisor, 5, and both terms

of the resulting fraction by 3, we have  $\frac{7}{8}$ , whose terms have no common divisor. Ans.  $\frac{7}{8}$ .

**151.** To change a fraction to smallest terms, —

*Divide both terms by any common divisor; treat the result in the same way, and so continue until a fraction is found whose terms have no common divisor.*

NOTE. The greater the divisor used, the shorter the process.

### ORAL AND WRITTEN EXERCISES.

1. Change  $\frac{3}{8}$  and  $\frac{1}{180}$  to smallest terms. |
2. James had \$ $\frac{3}{4}$ , Edward \$ $\frac{1}{24}$ , and Henry \$ $\frac{1}{144}$ . |  
Which had the most money?
3. A farmer gave  $\frac{9}{24}$  of his land to his eldest son, and  $\frac{3}{40}$  of it to his youngest daughter. Which one received the larger share?

Reduce the following fractions to smallest (or lowest) terms.

ORAL.			WRITTEN.		
4. $\frac{2}{4}, \frac{4}{8}$	18. $\frac{7}{21}, \frac{14}{21}$	32. $\frac{30}{42}$	46. $\frac{108}{120}$	60. $\frac{75}{225}$	
5. $\frac{8}{8}, \frac{4}{8}$	19. $\frac{15}{21}, \frac{8}{24}$	33. $\frac{12}{60}$	47. $\frac{15}{175}$	61. $\frac{84}{156}$	
6. $\frac{5}{10}, \frac{9}{10}$	20. $\frac{12}{24}, \frac{15}{24}$	34. $\frac{36}{60}$	48. $\frac{400}{450}$	62. $\frac{180}{324}$	
7. $\frac{8}{12}, \frac{4}{12}$	21. $\frac{21}{24}, \frac{21}{28}$	35. $\frac{48}{60}$	49. $\frac{182}{144}$	63. $\frac{150}{400}$	
8. $\frac{8}{12}, \frac{9}{12}$	22. $\frac{18}{30}, \frac{24}{27}$	36. $\frac{27}{63}$	50. $\frac{576}{1728}$	64. $\frac{144}{1728}$	
9. $\frac{10}{12}, \frac{6}{12}$	23. $\frac{20}{30}, \frac{15}{30}$	37. $\frac{48}{72}$	51. $\frac{182}{284}$	65. $\frac{108}{576}$	
10. $\frac{8}{9}, \frac{6}{9}$	24. $\frac{16}{24}, \frac{18}{24}$	38. $\frac{36}{72}$	52. $\frac{42}{348}$	66. $\frac{154}{308}$	
11. $\frac{6}{8}, \frac{10}{16}$	25. $\frac{24}{30}, \frac{24}{32}$	39. $\frac{50}{100}$	53. $\frac{352}{308}$	67. $\frac{168}{252}$	
12. $\frac{8}{16}, \frac{12}{16}$	26. $\frac{20}{32}, \frac{18}{32}$	40. $\frac{75}{100}$	54. $\frac{840}{1120}$	68. $\frac{875}{1000}$	
13. $\frac{14}{16}, \frac{9}{16}$	27. $\frac{24}{36}, \frac{9}{36}$	41. $\frac{80}{100}$	55. $\frac{625}{1000}$	69. $\frac{875}{1000}$	
14. $\frac{15}{18}, \frac{9}{21}$	28. $\frac{12}{36}, \frac{32}{36}$	42. $\frac{20}{100}$	56. $\frac{225}{250}$	70. $\frac{625}{1000}$	
15. $\frac{8}{10}, \frac{12}{18}$	29. $\frac{8}{48}, \frac{12}{48}$	43. $\frac{25}{100}$	57. $\frac{198}{383}$	71. $\frac{125}{1000}$	
16. $\frac{15}{20}, \frac{16}{20}$	30. $\frac{4}{48}, \frac{16}{48}$	44. $\frac{60}{100}$	58. $\frac{350}{320}$	72. $\frac{850}{1700}$	
17. $\frac{11}{22}, \frac{3}{21}$	31. $\frac{36}{48}, \frac{42}{48}$	45. $\frac{90}{100}$	59. $\frac{256}{800}$	73. $\frac{250}{3000}$	

**152. To change Fractions to Larger Terms.**

**Inductive Exercises.** — 1. In  $\frac{1}{2}$  an apple how many fourths of an apple?

2. In a half-dollar how many quarter-dollars?

3. How many tenths are there in  $\frac{1}{2}$ ? In  $\frac{1}{5}$ ?

4. How many twelfths are there in  $\frac{1}{2}$ ? In  $\frac{1}{3}$ ? In  $\frac{1}{4}$ ? The number of twelfths in anything is how many times the number of fourths? Thirds? Sixths?

5. Change  $\frac{3}{4}$  to twelfths.

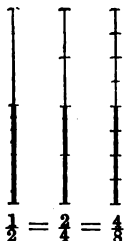
*Solution.* — Since  $1 = 12$  twelfths,  $\frac{1}{4} = \frac{1}{4}$  of 12 twelfths, or 3 twelfths, and  $\frac{3}{4} = 3 \times 3$  twelfths, or  $\frac{9}{12}$ . Hence  $\frac{3}{4} = \frac{9}{12}$ . Or,  $\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$ .

6. By what must both terms of  $\frac{3}{4}$  be multiplied to change it to twelfths? Of  $\frac{5}{8}$ ? Of  $\frac{2}{3}$ ?

7. Of the two fractions  $\frac{3}{4}$  and  $\frac{9}{12}$ , which expresses the larger equal parts? Which the greater number?

8. Change  $\frac{1}{2}$  to fourths. To eighths.

**ILLUSTRATION.**



*Solution.* — Multiplying both terms of  $\frac{1}{2}$  by 2, we have  $\frac{2}{4}$ ; multiplying both terms of  $\frac{2}{4}$  by 2, we have  $\frac{4}{8}$ . Hence  $\frac{1}{2} = \frac{2}{4}$  or  $\frac{4}{8}$ .

The illustration shows that the value of the fraction is not changed, the multiplication of both terms making the *size* of the parts *smaller*, while it makes their *number larger*.

**153.** *Multiplying both terms of a fraction by the same number does not change its value.*



9. Change  $\frac{5}{6}$  to twenty-fourths.

$$24 \div 6 = 4$$

$$\frac{5 \times 4}{6 \times 4} = \frac{20}{24}, \text{ Ans.}$$

*Solution.* — To change 6ths to 24ths both terms of the fraction must be multiplied by 4. Doing this we obtain  $\frac{20}{24}$ .

Hence

**154.** To change a fraction to larger terms, —

*Divide the required denominator by the given denominator, and multiply both terms of the fraction by the quotient.*

#### EXERCISES.

Change the following fractions to larger terms.

##### ORAL.

10.  $\frac{1}{2}, \frac{1}{3}$  to 6ths.
11.  $\frac{1}{4}, \frac{2}{4}$  to 8ths.
12.  $\frac{2}{3}, \frac{3}{4}$  to 12ths.
13.  $\frac{1}{6}, \frac{5}{6}$  to 12ths.
14.  $\frac{3}{8}, \frac{2}{4}$  to 16ths.
15.  $\frac{1}{2}, \frac{2}{3}$  to 18ths.
16.  $\frac{1}{5}, \frac{2}{4}$  to 20ths.
17.  $\frac{2}{5}, \frac{1}{4}$  to 20ths.
18.  $\frac{4}{7}, \frac{2}{3}$  to 21sts.
19.  $\frac{1}{6}, \frac{1}{8}$  to 24ths.
20.  $\frac{1}{3}, \frac{3}{8}$  to 24ths.
21.  $\frac{5}{6}, \frac{5}{8}$  to 24ths.
22.  $\frac{1}{6}, \frac{2}{5}$  to 30ths.

23.  $\frac{1}{4}, \frac{1}{5}$  to 36ths.
24.  $\frac{3}{4}, \frac{4}{9}$  to 36ths.
25.  $\frac{1}{7}, \frac{4}{5}$  to 35ths.
26.  $\frac{5}{6}, \frac{7}{9}$  to 36ths.
27.  $\frac{1}{6}, \frac{1}{7}$  to 42ds.
28.  $\frac{1}{6}, \frac{1}{8}$  to 48ths.
29.  $\frac{5}{6}, \frac{3}{8}$  to 48ths.
30.  $\frac{4}{5}, \frac{5}{9}$  to 45ths.
31.  $\frac{2}{3}, \frac{4}{7}$  to 63ds.
32.  $\frac{1}{8}, \frac{1}{9}$  to 72ds.
33.  $\frac{3}{8}, \frac{4}{9}$  to 72ds.
34.  $\frac{7}{8}, \frac{5}{9}$  to 72ds.
35.  $\frac{5}{8}, \frac{7}{9}$  to 72ds.

##### WRITTEN.

36.  $\frac{2}{5}$  to 75ths.
37.  $\frac{7}{5}$  to 75ths.
38.  $\frac{5}{18}$  to 72ds.
39.  $\frac{3}{8}$  to 96ths.
40.  $\frac{1}{24}$  to 96ths.
41.  $\frac{2}{48}$  to 96ths.
42.  $\frac{1}{25}$  to 100ths.
43.  $\frac{1}{20}$  to 100ths.
44.  $\frac{2}{50}$  to 100ths.
45.  $\frac{3}{4}$  to 128ths.
46.  $\frac{4}{8}$  to 144ths.
47.  $\frac{3}{8}$  to 144ths.
48.  $\frac{8}{72}$  to 144ths.

**155.** Fractions have a **Common Denominator** when their denominators are alike. As  $\frac{4}{12}, \frac{7}{12}, \frac{9}{12}$ .

**156. To change Fractions to Equivalent Fractions having a Common Denominator.**

**Inductive Exercises.** — 1. Name a number that will exactly contain 2 and 3.

2. Name a number exactly divisible by 4 and 6.

3. By what numbers may 36 be exactly divided?

4. What is the smallest number exactly divisible by 3, 4, and 6?

**157. A Common Multiple** of two or more numbers is any number exactly divisible by each of them, and the **Least Common Multiple** is the *least* number exactly divisible by each of them. Thus 12, 24, and 36 are *common multiples* of 3, 4, 6, and 12, and 12 is their *least common multiple*.

Name a common multiple of

5. 3 and 4.    7. 4 and 8.    9. 3 and 8.    11. 8 and 12.

6. 5 and 6.    8. 9 and 6.    10. 5 and 8.    12. 4 and 16.

Name the least common multiple of the above numbers.

13. What is a common multiple of the denominators of  $\frac{2}{3}$  and  $\frac{3}{4}$ ? What will be a common denominator of these fractions?

14. Change  $\frac{2}{3}$  and  $\frac{3}{4}$  to a common denominator.

$$\frac{2}{3} \times 4 = \frac{8}{12}$$

$$\frac{3}{4} \times 3 = \frac{9}{12}$$

*Solution.* — As 12 is a common multiple of 3 and 4, we multiply both terms of each fraction by the number that will change the fraction to 12ths. Hence

**158.** To change fractions to equivalent fractions having a common denominator, —

*Multiply both terms of each fraction by any number that will make the denominators alike.*

NOTE. The smaller the common multiple used, the shorter the process. If no smaller multiple can be readily found, use the product of the denominators.

## EXERCISES.

Change the following to fractions having a common denominator.

## ORAL.

Perform again  
Exercises 10 to 36  
on page 101.

1.  $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
2.  $\frac{1}{2}, \frac{2}{3}, \frac{11}{12}$
3.  $\frac{1}{2}, \frac{2}{4}, \frac{7}{8}$
4.  $\frac{1}{4}, \frac{5}{8}, \frac{3}{16}$
5.  $\frac{1}{3}, \frac{1}{5}, \frac{4}{15}$
6.  $\frac{1}{2}, \frac{3}{4}, \frac{1}{5}$
7.  $\frac{1}{4}, \frac{2}{5}, \frac{1}{2}$
8.  $\frac{2}{5}, \frac{3}{4}, \frac{7}{10}$
9.  $\frac{1}{4}, \frac{1}{6}, \frac{2}{3}$
10.  $\frac{3}{4}, \frac{5}{6}, \frac{1}{8}$
11.  $\frac{3}{4}, \frac{5}{6}, \frac{2}{3}$
12.  $\frac{1}{4}, \frac{1}{6}, \frac{1}{9}$
13.  $\frac{5}{6}, \frac{4}{9}, \frac{7}{12}$
14.  $\frac{2}{4}, \frac{4}{5}, \frac{7}{8}$

## WRITTEN.

15.  $\frac{5}{8}, \frac{7}{9}, \frac{11}{12}$
16.  $\frac{2}{3}, \frac{5}{12}, \frac{1}{16}$
17.  $\frac{3}{25}, \frac{2}{5}, \frac{49}{50}$
18.  $\frac{19}{20}, \frac{29}{30}, \frac{41}{60}$
19.  $\frac{5}{16}, \frac{13}{32}, \frac{1}{64}$
20.  $\frac{1}{2}, \frac{2}{8}, \frac{14}{64}$
21.  $\frac{1}{8}, \frac{1}{9}, \frac{1}{12}$
22.  $\frac{5}{8}, \frac{7}{9}, \frac{7}{12}$
23.  $\frac{3}{4}, \frac{5}{9}, \frac{7}{18}$
24.  $\frac{2}{3}, \frac{7}{9}, \frac{11}{12}$
25.  $\frac{8}{9}, \frac{5}{24}, \frac{13}{72}$
26.  $\frac{4}{10}, \frac{2}{7}, \frac{17}{70}$
27.  $\frac{4}{5}, \frac{6}{7}, \frac{21}{70}$
28.  $\frac{3}{4}, \frac{7}{8}, \frac{9}{10}$
29.  $\frac{6}{10}, \frac{5}{8}, \frac{15}{40}$
30.  $\frac{1}{12}, \frac{1}{7}, \frac{37}{42}$
31.  $\frac{7}{12}, \frac{5}{7}, \frac{11}{84}$
32.  $\frac{1}{8}, \frac{1}{12}, \frac{1}{16}$
33.  $\frac{3}{8}, \frac{5}{12}, \frac{11}{96}$
34.  $\frac{5}{8}, \frac{7}{12}, \frac{13}{16}$
35.  $\frac{11}{25}, \frac{43}{50}, \frac{17}{100}$
36.  $\frac{11}{20}, \frac{13}{50}, \frac{49}{100}$
37.  $\frac{6}{25}, \frac{9}{50}, \frac{48}{100}$
38.  $\frac{1}{2}, \frac{1}{4}, \frac{71}{100}$
39.  $\frac{3}{4}, \frac{8}{10}, \frac{61}{100}$
40.  $\frac{1}{5}, \frac{9}{10}, \frac{89}{100}$
41.  $\frac{1}{12}, \frac{1}{9}, \frac{15}{108}$
42.  $\frac{5}{12}, \frac{7}{9}, \frac{67}{108}$
43.  $\frac{1}{20}, \frac{1}{30}, \frac{11}{120}$
44.  $\frac{13}{20}, \frac{17}{30}, \frac{129}{120}$
45.  $\frac{1}{40}, \frac{11}{60}, \frac{71}{120}$
46.  $\frac{1}{12}, \frac{1}{8}, \frac{7}{96}$
47.  $\frac{13}{24}, \frac{1}{36}, \frac{119}{144}$
48.  $\frac{11}{36}, \frac{15}{48}, \frac{122}{144}$

## ADDITION OF FRACTIONS.

**159. Inductive Exercises.** — 1. Henry has  $\frac{3}{5}$  of a dollar, and James has  $\frac{2}{5}$ . How many fifths have both?

2. How many sixths are  $\frac{2}{3}$  and  $\frac{1}{3}$ ?

3. How many fourths are  $\frac{1}{2}$  and  $\frac{1}{4}$ ? What change must be made in  $\frac{1}{2}$  before it can be added to  $\frac{1}{4}$ ?

4.  $\frac{1}{8} + \frac{2}{8} + \frac{1}{8} =$  how many eighths?

5.  $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} =$  how many eighths? What change must be made in the form of these fractions before adding?

**160. Like Fractions** are like parts of the same unit. Thus  $\$ \frac{2}{6}$ ,  $\$ \frac{3}{6}$ , and  $\$ \frac{1}{6}$  are like parts (sixths) of the same unit (\$1).

*Only like fractions can be added and subtracted.*

6. Add  $\frac{3}{4}$ ,  $\frac{1}{6}$ , and  $\frac{7}{10}$  together.

$$\frac{3}{4} + \frac{1}{6} + \frac{7}{10} = \frac{15}{20} + \frac{3}{20} + \frac{14}{20} = \frac{32}{20} = 2\frac{8}{20}, \text{ or } 2\frac{1}{2}, \text{ Ans.}$$

*Solution.* — Changing the fractions to fractions having a common denominator, 20, and adding their numerators, we have  $\frac{15}{20}$ , or  $2\frac{8}{20}$ , or  $2\frac{1}{2}$ , for the sum. Hence,

**161.** To add fractions, —

*Change them, if necessary, to fractions having a common denominator, add their numerators, and under the sum write the common denominator.*

**NOTE.** When possible, change the result to a simpler form.

7. Find the sum of  $18\frac{7}{8}$  and  $19\frac{5}{8}$ .

$$18\frac{7}{8} = 18\frac{31}{32}$$

$$19\frac{5}{8} = 19\frac{20}{32}$$

$$\frac{117}{32}$$

$$37$$

$$38\frac{17}{32}, \text{ Ans.}$$

*Solution.*—The sum of the fractions is  $\frac{11}{8}$ , or  $1\frac{1}{4}$ ; the sum of the integers is 37. Uniting these two results, we have  $38\frac{1}{4}$ , Ans. Hence,

**162.** To add mixed numbers, —

*Add the fractions and integers separately, and unite the results.*

### 163. EXERCISES.

Find the sum of the following fractions or mixed numbers.

#### ORAL.

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| 1. $\frac{1}{2} + \frac{1}{4}$  | 11. $1\frac{1}{2} + 2\frac{3}{8}$ |
| 2. $\frac{1}{2} + \frac{1}{8}$  | 12. $2\frac{3}{4} + 1\frac{1}{2}$ |
| 3. $\frac{1}{3} + \frac{1}{4}$  | 13. $3\frac{3}{4} + 2\frac{1}{6}$ |
| 4. $\frac{1}{2} + \frac{1}{6}$  | 14. $3\frac{4}{5} + 3\frac{2}{3}$ |
| 5. $\frac{1}{3} + \frac{1}{6}$  | 15. $4\frac{1}{4} + 5\frac{4}{5}$ |
| 6. $\frac{1}{2} + \frac{1}{8}$  | 16. $3\frac{1}{6} + 1\frac{2}{3}$ |
| 7. $\frac{1}{3} + \frac{1}{6}$  | 17. $3\frac{2}{3} + 2\frac{2}{3}$ |
| 8. $\frac{1}{4} + \frac{1}{6}$  | 18. $2\frac{1}{8} + 4\frac{3}{4}$ |
| 9. $\frac{1}{4} + \frac{1}{6}$  | 19. $6\frac{1}{2} + 5\frac{3}{8}$ |
| 10. $\frac{1}{5} + \frac{1}{6}$ | 20. $5\frac{3}{4} + 6\frac{5}{8}$ |

#### WRITTEN.

**1 to 48.** Find the sum of the fractions in Exercises 1 to 48 on page 103.

- |  |
|--|
| 49. $15\frac{2}{3} + 13\frac{5}{6} + 3\frac{1}{2}$     |
| 50. $18\frac{3}{4} + 17\frac{5}{8} + 19$               |
| 51. $141\frac{7}{8} + 192\frac{3}{4}$                  |
| 52. $4\frac{2}{5} + 13\frac{7}{10} + 16\frac{31}{50}$  |
| 53. $83 + 94\frac{1}{4} + 61\frac{1}{5}$               |
| 54. $9\frac{2}{3} + 17\frac{3}{4} + 16\frac{5}{6}$     |
| 55. $33\frac{1}{3} + 66\frac{2}{3} + 51\frac{7}{8}$    |
| 56. $5\frac{4}{9} + 6\frac{2}{3} + 18$                 |
| 57. $18\frac{5}{8} + 16\frac{7}{8} + 144\frac{5}{8}$   |
| 58. $90\frac{2}{5} + 80\frac{7}{10} + 100\frac{7}{10}$ |
| 59. $89 + 7\frac{8}{9} + 1\frac{2}{3}$                 |
- 21 to 47.** Find the sum of the fractions in Exercises 10 to 36 on page 101.

## SUBTRACTION OF FRACTIONS.

**164. Inductive Exercises.** — 1. A dressmaker cut  $\frac{3}{8}$  of a yard of cloth from a piece  $\frac{5}{8}$  of a yard long. How many eighths were left?

2. A lad who had  $\$ \frac{4}{5}$  spent  $\$ \frac{3}{10}$ . How many tenths had he left?

3. From  $\frac{5}{8}$  of a foot take  $\frac{1}{8}$  of a foot, and what is left?

4. Mr. Ames sold  $\frac{3}{4}$  of his farm. What part had he left?

5.  $\frac{5}{7} - \frac{3}{7} = ?$       6.  $\frac{5}{8} - \frac{1}{4} = ?$       7.  $\frac{1}{12} - \frac{5}{6} = ?$

8. From  $3\frac{1}{2}$  take  $1\frac{1}{2}$ .      9. From 1 take  $\frac{3}{4}$ .

10. I bought 2 tons of coal and sold  $1\frac{1}{4}$  tons. How much was left?

11. Find the difference between  $\frac{8}{9}$  and  $\frac{5}{8}$ .

$\frac{8}{9} - \frac{5}{8} = \frac{16}{18} - \frac{15}{18} = \frac{1}{18}$ , Ans.      *Solution.*—Changing the fractions to fractions having

a common denominator, we take the difference of the numerators and write it over the common denominator, and have  $\frac{1}{18}$  as the difference required. Hence,

**165.** To subtract one fraction from another, —

*Change the fractions, if necessary, to fractions having a common denominator, and then write the difference of the new numerators over the common denominator.*

12. What is the difference between 7 and  $\frac{3}{8}$ ?

*Solution.* —  $7 - \frac{3}{8} = 6\frac{7}{8} - \frac{3}{8} = 6\frac{4}{8}$ , Ans.

13. Subtract  $17\frac{5}{8}$  from  $108\frac{2}{3}$ .

$$108\frac{2}{3} = 108\frac{16}{24} = 107\frac{42}{24}$$

$$17\frac{5}{8} = 17\frac{15}{24} = 17\frac{25}{24}$$

$$90\frac{17}{24}, \text{ Ans.}$$

*Solution.* — We first change the fractions to like fractions. As the fraction of the subtrahend

is larger than the fraction of the minuend, we take 1, or  $\frac{24}{24}$ , from 108, leaving 107; adding the  $\frac{24}{24}$  to the  $\frac{16}{24}$ , we have  $\frac{40}{24}$ .  $\frac{40}{24}$  less  $\frac{25}{24} = \frac{15}{24}$ ; 107 less 17 = 90. Uniting these two results, we have  $90\frac{15}{24}$  as the remainder required.

### 166. EXERCISES.

Find the value of

#### ORAL.

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. $\frac{1}{3} - \frac{1}{4}$  | 14. $\frac{5}{6} - \frac{1}{8}$  |
| 2. $\frac{1}{4} - \frac{1}{6}$  | 15. $\frac{5}{8} - \frac{2}{9}$  |
| 3. $\frac{1}{2} - \frac{2}{3}$  | 16. $\frac{2}{5} - \frac{5}{9}$  |
| 4. $\frac{1}{2} - \frac{1}{8}$  | 17. $\frac{5}{8} - \frac{5}{12}$ |
| 5. $\frac{3}{4} - \frac{1}{8}$  | 18. $\frac{7}{8} - \frac{5}{8}$  |
| 6. $\frac{4}{5} - \frac{1}{2}$  | 19. $\frac{8}{9} - \frac{3}{8}$  |
| 7. $\frac{2}{3} - \frac{1}{4}$  | 20. $\frac{3}{4} - \frac{2}{9}$  |
| 8. $\frac{3}{4} - \frac{2}{3}$  | 21. $8 - \frac{5}{8}$            |
| 9. $\frac{5}{8} - \frac{1}{2}$  | 22. $8\frac{1}{2} - \frac{3}{4}$ |
| 10. $\frac{7}{8} - \frac{3}{4}$ | 23. $2\frac{1}{2} - \frac{2}{3}$ |
| 11. $\frac{2}{3} - \frac{1}{5}$ | 24. $3\frac{1}{5} - \frac{4}{5}$ |
| 12. $\frac{4}{5} - \frac{2}{3}$ | 25. $2\frac{7}{8} - \frac{5}{8}$ |
| 13. $\frac{2}{3} - \frac{2}{3}$ | 26. $3\frac{1}{5} - \frac{2}{4}$ |

#### WRITTEN.

- |                                      |   |
|--------------------------------------|---|
| 27. $\frac{8}{9} - \frac{3}{8}$      | 40. $18\frac{1}{5} - 2\frac{1}{10}$     |
| 28. $\frac{13}{18} - \frac{5}{10}$   | 41. $16\frac{1}{8} - 5\frac{3}{4}$      |
| 29. $\frac{195}{880} - \frac{3}{10}$ | 42. $129\frac{1}{8} - 85\frac{11}{12}$  |
| 30. $\frac{17}{24} - \frac{4}{9}$    | 43. $69\frac{2}{3} - 47\frac{3}{4}$     |
| 31. $\frac{8}{12} - \frac{5}{9}$     | 44. $16\frac{5}{8} - 12\frac{7}{8}$     |
| 32. $\frac{81}{180} - \frac{1}{18}$  | 45. $84\frac{9}{25} - 12\frac{10}{5}$   |
| 33. $\frac{29}{48} - \frac{7}{36}$   | 46. $69\frac{4}{5} - \frac{8}{9}$       |
| 34. $\frac{15}{49} - \frac{1}{7}$    | 47. $25\frac{4}{9} - 1\frac{7}{18}$     |
| 35. $\frac{67}{144} - \frac{25}{72}$ | 48. $84\frac{9}{32} - 7\frac{7}{8}$     |
| 36. $\frac{191}{300} - \frac{1}{5}$  | 49. $91\frac{8}{11} - 7\frac{6}{7}$     |
| 37. $\frac{16}{25} - \frac{7}{20}$   | 50. $18\frac{21}{50} - 6\frac{46}{100}$ |
| 38. $\frac{81}{100} - \frac{13}{20}$ | 51. $94 - 7\frac{5}{18}$                |
| 39. $\frac{9}{50} - \frac{3}{60}$    | 52. $85\frac{5}{9} - 16\frac{11}{12}$   |

53. Subtract the difference between  $\frac{4}{5}$  and  $\frac{5}{6}$  from their sum.

54.  $87\frac{3}{4}$  gallons are drawn from a reservoir containing  $124\frac{3}{8}$  gallons. How many gallons remain?

55. How much larger is  $\frac{17}{18}$  than  $\frac{15}{18}$ ?

**167. ORAL EXERCISES.**

1. Mary had  $\$ \frac{3}{4}$ , her mother gave her  $\$ 2\frac{1}{2}$ , and she then spent  $\$ 1\frac{1}{4}$ . How much had she left?

2. John picked half a bushel of walnuts and sold  $\frac{3}{16}$  of a bushel. How many did he keep?

3. I bought  $8\frac{1}{2}$  tons of coal for my winter's supply. At the end of the season I had  $\frac{3}{4}$  of a ton left. How much did I burn?

4. Farmer B. told his two boys that he could saw more wood in a day than both of them together. He sawed  $1\frac{3}{8}$  cords. One boy sawed  $\frac{5}{16}$  of a cord, and the other  $\frac{3}{4}$  of a cord. Which sawed the more, the farmer or the boys, and how much?

5. I have  $\$ 5\frac{1}{2}$ . I pay  $\$ 1\frac{1}{4}$  for a chair, and  $\$ 2\frac{3}{8}$  for a hammock. How much have I left?

6. If you are in school  $5\frac{1}{2}$  hours, at play  $4\frac{1}{4}$  hours, at meals  $1\frac{1}{8}$  hours, at work 3 hours, and sleep the rest of the day, how many hours do you sleep?

7. A mechanic earns  $\$ 9\frac{1}{4}$  a week, and his expenses are  $\$ 4\frac{3}{8}$ . How much does he save?

8. Henry is saving his money to buy a velocipede which costs  $\$ 7\frac{1}{2}$ . He has  $\$ 5\frac{1}{4}$ . How much more does he need? )

9. What must be added to the sum of  $\frac{5}{8}$  and  $10\frac{1}{2}$  to make 20?

10.  $\frac{1}{3}$  of my money is in bills,  $\frac{3}{8}$  of it is in silver, and the rest is in gold. What part is in gold?



**168. WRITTEN EXERCISES.**

1. In a yacht race the Flyaway sailed  $54\frac{1}{8}$  miles in 4 hours, and the Victor  $67\frac{1}{8}$  miles in the same time. By how many miles did the Victor win?

2. Bought 640 acres of land, and sold  $15\frac{1}{2}$  acres to one man and  $126\frac{7}{16}$  acres to another. How much had I left?

3. A man willed  $\frac{1}{2}$  his property to his wife,  $\frac{3}{8}$  to his son,  $\frac{1}{16}$  to his daughter, and the remainder to a college. What part did he give to the college?

4. From a cask of vinegar containing  $39\frac{7}{8}$  gallons,  $8\frac{1}{2}$  gallons were drawn at one time and  $6\frac{3}{4}$  at another. How many gallons remained?

5. When coal is bought for  $\$7\frac{9}{10}$  a ton and sold for  $\$8\frac{1}{4}$ , how much is gained?

6.  $9\frac{7}{8}$  yards were cut from a roll of paper and  $4\frac{1}{9}$  yards were left. What was the length of the roll?

7. In a rain storm  $\frac{5}{8}$  of an inch fell in the first hour,  $\frac{1}{8}$  the next, and  $\frac{1}{2}$  the third hour. How many inches of rain fell in all?

8. On Monday a man walked east  $13\frac{5}{8}$  miles, and on Tuesday  $26\frac{1}{8}$  miles. On Wednesday he walked west  $17\frac{5}{8}$  miles. How far was he then from his starting place?

9. What is gained on a pound when wool is bought at  $\$.37\frac{1}{2}$  and sold at  $\$.43\frac{1}{4}$ ?

10. The owner of  $\frac{5}{6}$  of a mill sold  $\frac{1}{8}$  the mill to one man and  $\frac{1}{8}$  to another. What part did he still own?

## MULTIPLICATION OF FRACTIONS.

**169.** To find the Product of a Fraction and an Integer.

**Inductive Exercises.**—1. How many fourths are 2 times 3 fourths?

2. What part of a dollar is  $3 \times \$\frac{1}{4}$ ?  $5 \times \$\frac{1}{10}$ ?

3. If a pound of tea costs  $\$ \frac{5}{8}$ , what will 4 pounds cost?

*Solution.*—As 1 pound costs  $\$ \frac{5}{8}$ , 4 pounds cost  $4 \times \$ \frac{5}{8}$ , or  $\$ \frac{20}{8} = \$ 2\frac{1}{2}$ , or  $\$ 2\frac{1}{2}$ .

4. What will 2 yards of ribbon cost at  $\$ \frac{7}{8}$  a yard?

5. In finding 2 times  $\frac{7}{8}$ , which term of the fraction did you multiply? Did you change the size of the equal parts?

6. If instead of multiplying the 7 by 2, you had divided the 8 by 2, what result would you have had? Would the size of the equal parts have been changed? Would their number?

7. Find 3 times  $\frac{5}{8}$ .

*1st Solution.*— $3 \times \frac{5}{8} = \frac{15}{8}$ , or  $1\frac{7}{8}$ , or  $1\frac{7}{8}$ .

*2d Solution.*— $3 \times \frac{5}{8} = \frac{15}{8}$ , or  $1\frac{7}{8}$ .

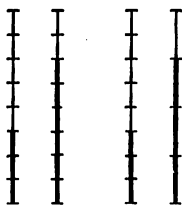
8. In the first solution we multiply the numerator by 3, and in the second we divide the denominator by 3. Are the results the same? Which is the shorter process?

9. In the first solution how did we change the number of equal parts? Their size?

10. In the second solution how did we change the size of the equal parts? Their number?

**11.** Find the value of 2 times  $\frac{3}{8}$ .

ILLUSTRATION.



$$2 \times \frac{3}{8} = \frac{6}{8} \text{ or } 2) \frac{3}{8} = \frac{3}{4}$$

*Solution.* — By multiplying the numerator of  $\frac{3}{8}$  by 2 we have  $\frac{6}{8}$ , or  $\frac{3}{4}$ ; or by dividing the denominator of  $\frac{3}{8}$  by 2 we have  $\frac{3}{4}$ .

It will be seen by the illustration that either method multiplies the fraction. The first *increases* the number of equal parts, while the size remains the same, and the second *increases* their size, while the number remains the same. Hence,

**170.** A fraction may be multiplied either by multiplying its numerator or by dividing its denominator.

Multiply

12.  $\frac{5}{16}$  by 8. 14.  $\frac{7}{12}$  by 4. 16.  $\frac{9}{20}$  by 10. 18.  $\frac{5}{14}$  by 7.13.  $\frac{3}{16}$  by 9. 15.  $\frac{5}{12}$  by 5. 17.  $\frac{11}{20}$  by 7. 19.  $\frac{3}{9}$  by 8.20. What is  $\frac{1}{2}$  of 4 apples?  $\frac{1}{2}$  of 5 apples?21. What is  $\frac{1}{5}$  of 10? Of 12?  $\frac{1}{3}$  of 12?  $\frac{2}{3}$  of 12?22. If a ton costs \$10, what will  $\frac{2}{5}$  of a ton cost?

*Solution.* — As 1 ton costs \$10,  $\frac{1}{5}$  of a ton costs  $\frac{1}{5}$  of \$10, or \$2;  $\frac{2}{5}$  of a ton costs  $2 \times \$2$ , or \$4.

**23.** What is the difference between  $7 \times 8$  and  $8 \times 7$ ?  $\frac{3}{4} \times 12$  and  $12 \times \frac{3}{4}$ ?

*Solution.* — We have learned (Art. 80) that the product is the same, whatever the order of factors.  $7 \times 8$  is, therefore the same as  $8 \times 7$ , and  $\frac{3}{4}$  times 12 is the same as  $12 \times \frac{3}{4}$ . It is customary, however, when the fraction is the *multiplier*, to say  $\frac{3}{4}$  of 12 instead of  $\frac{3}{4}$  times 12. The word *of* after a fractional multiplier is the same as the sign of multiplication. Hence,

*Multiplying an integer by a fraction is the same as multiplying a fraction by an integer.*

**171. ORAL AND WRITTEN EXERCISES.**1. What are 16 times  $\frac{5}{12}$ ?1st Process.  $\frac{5}{12} \times 16 = \frac{80}{12}$ , or  $6\frac{2}{3}$ , Ans.
$$\begin{array}{c} 4 \\ 2d \text{ Process. } 16 \times \frac{5}{12} = 6\frac{2}{3}, \text{ Ans.} \end{array}$$

*Solution.* — 16 times  $\frac{5}{12}$  are  $\frac{80}{12}$ ; changing  $\frac{80}{12}$  to smallest terms by dividing both terms by 4 (Art. 150), we have  $6\frac{2}{3}$ , or  $6\frac{2}{3}$ , Ans. In the second process we divide both terms by 4 before multiplying. 4 in 16 = 4; 4 in 12 = 3. We then have  $4 \times \frac{5}{3} = \frac{20}{3}$ , or  $6\frac{2}{3}$ , Ans.

This dividing by, or striking out, equal factors in both numerator and denominator is called *cancellation*. It may very often be used in multiplication and division of fractions to shorten the process.

Find the product of the following fractions and integers: —

ORAL.				WRITTEN.	
2. $7 \times \frac{1}{2}$	16. $\frac{1}{8}$ of 15	30. $\frac{1}{8}$ of 100	44. $\frac{7}{20}$ of 50		
3. $8 \times \frac{1}{3}$	17. $\frac{4}{5}$ of 15	31. $72 \times \frac{8}{9}$	45. $36 \times \frac{1}{4}\frac{5}{6}$		
4. $9 \times \frac{1}{4}$	18. $\frac{7}{8}$ of 24	32. $\frac{2}{15}$ of 65	46. $\frac{11}{28}$ of 21		
5. $11 \times \frac{1}{5}$	19. $\frac{5}{6}$ of 24	33. $35 \times \frac{7}{10}$	47. $100 \times \frac{9}{25}$		
6. $5 \times \frac{2}{3}$	20. $\frac{3}{7}$ of 21	34. $\frac{8}{9}$ of 66	48. $\frac{2}{15}$ of 100		
7. $6 \times \frac{3}{4}$	21. $\frac{5}{9}$ of 27	35. $64 \times \frac{7}{24}$	49. $25 \times \frac{8}{11}$		
8. $3 \times \frac{4}{5}$	22. $\frac{3}{4}$ of 20	36. $\frac{3}{4}$ of 200	50. $\frac{5}{82}$ of 48		
9. $5 \times \frac{5}{8}$	23. $\frac{2}{3}$ of 21	37. $\frac{5}{8} \times 100$	51. $\frac{13}{24} \times 40$		
10. $7 \times \frac{3}{4}$	24. $\frac{1}{3}$ of 27	38. $\frac{3}{8}$ of 100	52. $\frac{7}{12}$ of 90		
11. $8 \times \frac{2}{9}$	25. $\frac{2}{3}$ of 27	39. $36 \times \frac{5}{16}$	53. $45 \times \frac{5}{12}$		
12. $10 \times \frac{2}{3}$	26. $\frac{4}{9}$ of 72	40. $\frac{3}{5}$ of 76	54. $\frac{11}{12}$ of 80		
13. $7 \times \frac{4}{5}$	27. $\frac{5}{8}$ of 80	41. $63 \times \frac{5}{18}$	55. $60 \times \frac{8}{9}$		
14. $6 \times \frac{3}{8}$	28. $\frac{7}{10}$ of 30	42. $\frac{7}{16}$ of 320	56. $\frac{8}{32}$ of 56		
15. $10 \times \frac{5}{8}$	29. $\frac{9}{10}$ of 80	43. $\frac{11}{24} \times 90$	57. $75 \times \frac{1}{50}$		

**172. To find the Product of an Integer and a Mixed Number.**

**Inductive Exercises.** — 1. What will  $2\frac{3}{4}$  yards of silk cost at \$5 a yard?

*Solution.* — As 1 yard costs \$5,  $2\frac{3}{4}$  yards will cost  $2\frac{3}{4}$  times \$5.  $\frac{1}{4}$  of \$5 is \$ $\frac{5}{4}$ , and  $\frac{3}{4}$  of \$5 are  $3 \times \$\frac{5}{4}$ , or \$ $\frac{15}{4}$ , or \$3 $\frac{3}{4}$ .  $2 \times \$5$  are \$10. \$10 + \$3 $\frac{3}{4}$  are \$13 $\frac{3}{4}$ , Ans.

2. Find the cost of  $2\frac{3}{4}$  yards at \$4 a yard.

3. What will 5 bushels of wheat cost at \$1 $\frac{3}{5}$  a bushel?

*Solution.* — As 1 bushel costs \$1 $\frac{3}{5}$ , 5 bushels cost  $5 \times \$1\frac{3}{5}$ .  $5 \times \$\frac{3}{5} = \$3$ , or \$1 $\frac{3}{5}$ .  $5 \times \$1 = \$5$ . \$5 + \$3 = \$8, Ans.

4. If one man digs  $4\frac{1}{5}$  bushels of potatoes in a day, how many bushels will 7 men dig?

5. Find the product of  $14\frac{3}{5}$  and 18.

1st Process.

$$\begin{array}{r} 14\frac{3}{5} \\ 18 \\ 5 \overline{) 54} \\ \underline{10\frac{3}{5}} \\ 112 \\ 14 \\ \underline{262\frac{3}{5}}, \text{ Ans.} \end{array}$$

2d Process.

$$\begin{array}{r} 18 \\ 14\frac{3}{5} \\ 5 \overline{) 54} \\ \underline{10\frac{3}{5}} \\ 72 \\ 18 \\ \underline{262\frac{3}{5}}, \text{ Ans.} \end{array}$$

*Solution.* — In the first process we use the integer as the multiplier.  $18 \times \frac{3}{5}$  are  $\frac{54}{5}$ , or  $10\frac{4}{5}$ .  $8 \times 14 = 112$ , and  $10 \times 14 = 140$ . Uniting these three partial products, we have  $262\frac{3}{5}$  as the answer.

In the second process we use the mixed number as the multiplier.  $\frac{3}{5}$  of 18 =  $\frac{54}{5}$ , or  $10\frac{4}{5}$ .  $4 \times 18 = 72$ , and  $10 \times 18 = 180$ . Uniting these three partial products, we have as before  $262\frac{3}{5}$ , Ans.

In multiplication we generally use the smaller of the two numbers as the multiplier, care being taken in explanations to consider the *real* multiplier abstract and the *real* multiplicand of the same denomination as the product. (Art. 80.)

**173.** To find the product of an integer and a mixed number, —

*First find the product of the integer and the fraction, and then the product of the two integers, and add the results.*

## EXERCISES.

Find the product of the following numbers : —

## ORAL.

1.  $6 \times 1\frac{1}{2}$
2.  $5 \times 1\frac{1}{3}$
3.  $7 \times 2\frac{1}{4}$
4.  $2\frac{1}{2} \times 5$
5.  $1\frac{3}{4} \times 6$
6.  $3\frac{2}{3} \times 7$
7.  $4\frac{1}{2} \times 9$
8.  $5 \times 6\frac{3}{4}$
9.  $8 \times 2\frac{1}{8}$
10.  $8 \times 5\frac{3}{8}$
11.  $9 \times 4\frac{5}{8}$
12.  $10 \times 5\frac{7}{8}$
13.  $2\frac{1}{2} \times 7$
14.  $9 \times 3\frac{5}{8}$
15.  $12 \times 2\frac{1}{8}$
16.  $5 \times 4\frac{7}{10}$
17.  $8\frac{3}{10} \times 9$
18.  $7\frac{1}{2} \times 13$

## WRITTEN.

- |                              |                               |
|------------------------------|-------------------------------|
| 19. $3\frac{2}{5} \times 65$ | 28. $14\frac{2}{7} \times 95$ |
| 20. $4\frac{3}{4} \times 76$ | 29. $33\frac{1}{3} \times 17$ |
| 21. $5\frac{5}{8} \times 18$ | 30. $8 \times 66\frac{2}{3}$  |
| 22. $7 \times 27\frac{3}{4}$ | 31. $19 \times 87\frac{1}{2}$ |
| 23. $9 \times 37\frac{1}{2}$ | 32. $13 \times 31\frac{1}{4}$ |
| 24. $6 \times 62\frac{1}{2}$ | 33. $4 \times 57\frac{5}{8}$  |
| 25. $6\frac{3}{4} \times 75$ | 34. $8\frac{7}{8} \times 100$ |
| 26. $8 \times 16\frac{3}{4}$ | 35. $7\frac{3}{8} \times 84$  |
| 27. $11 \times 9\frac{1}{4}$ | 36. $66\frac{3}{4} \times 75$ |

**37.** How far will a pedestrian walk in 24 hours if he walks  $4\frac{1}{5}$  miles an hour?

**38.** If one egg weighs  $2\frac{3}{8}$  ounces, what will a dozen weigh?

The price of one pound, &c., being given, find the cost of

- |   |  |
|---|--|
| 39. $2\frac{1}{4}$ pounds at \$.12.     | 46. $6\frac{5}{8}$ pounds at \$.25.      |
| 40. $3\frac{1}{7}$ weeks' board at \$5. | 47. 125 gallons at \$.37 $\frac{1}{2}$ . |
| 41. 6 yards at \$.12 $\frac{1}{2}$ .    | 48. 200 yards at \$.41 $\frac{1}{2}$ .   |
| 42. 8 chairs at \$2 $\frac{1}{4}$ .     | 49. 57 tons at \$7 $\frac{1}{8}$ .       |
| 43. $3\frac{3}{8}$ bushels at \$2.      | 50. $18\frac{3}{4}$ bushels at \$.65.    |
| 44. $4\frac{1}{5}$ gallons at \$.10.    | 51. $5\frac{1}{2}$ dozen at \$2.50.      |
| 45. $3\frac{5}{8}$ pecks at \$.06.      | 52. $6\frac{5}{12}$ reams at \$3.75.     |

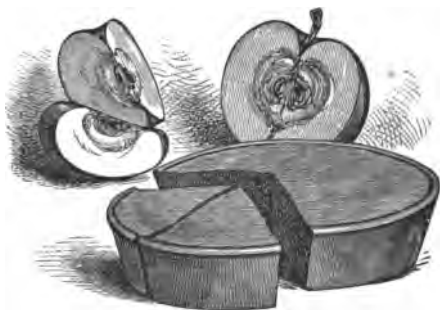
**174. To find the Product of Fractions and Mixed Numbers.**

**Inductive Exercises.** — 1. What part of an apple is  $\frac{1}{2}$  of half of it?

2. How much of a cake is  $\frac{1}{2}$  of  $\frac{1}{3}$  of a cake?  $\frac{1}{2}$  of  $\frac{2}{3}$  of it?

3. What is 1 third of  $\frac{3}{4}$ ? 2 thirds of  $\frac{3}{4}$ ?

4. What is  $\frac{3}{4}$  of  $\frac{2}{5}$ ?



*Solution.* —  $\frac{1}{2}$  of  $\frac{2}{5}$  is  $\frac{2}{10}$ ;  $\frac{2}{3}$  of  $\frac{3}{4}$  =  $3 \times \frac{2}{10}$ , or  $\frac{6}{10}$ .

5. Find the product of  $\frac{9}{10}$  and  $\frac{5}{8}$ .

*1st Process.*

$$\frac{9}{10} \times \frac{5}{8} = \frac{45}{80} = \frac{9}{16}, \text{ Ans.}$$

*2d Process.*

$$\frac{\overset{3}{9}}{\underset{2}{10}} \times \frac{\overset{5}{5}}{\underset{2}{8}} = \frac{3}{4}, \text{ Ans.}$$

*Solution.* — As the product is the same, whatever the order of factors (Art. 80),  $\frac{9}{10} \times \frac{5}{8}$  is the same as  $\frac{5}{8}$  of  $\frac{9}{10}$ .  $\frac{1}{10}$  of  $\frac{9}{10} = \frac{9}{100}$ , and  $\frac{5}{8}$  of  $\frac{9}{100} = 5 \times \frac{9}{800}$ , or  $\frac{45}{800}$ . Changing  $\frac{45}{800}$  to lowest terms, by striking out the common factors 3 and 5 from each term, we have

$\frac{3}{16}$ , Ans. In the second process we have struck out or canceled these common factors before multiplying.

6. Multiply  $4\frac{2}{5}$  by  $6\frac{3}{8}$ .

$$4\frac{2}{5} = \frac{22}{5}, \text{ and } 6\frac{3}{8} = \frac{51}{8}.$$

$$\frac{22}{5} \times \frac{\overset{4}{20}}{3} = \frac{88}{3} = 29\frac{1}{3}.$$

*Solution.* — Changing the mixed numbers to improper fractions, we have  $\frac{22}{5} \times \frac{51}{8} = \frac{1122}{40}$ , or  $29\frac{1}{3}$ . Hence,

**175.** To find the product of fractions and mixed numbers, —

*Change the mixed numbers to improper fractions, and then multiply all the numerators together for the numerator of the product, and all the denominators for the denominator of the product.*

### 176. EXERCISES.

Find the product of the following fractions and mixed numbers :—

#### ORAL.

- |                                      |  |
|--------------------------------------|--|
| 1. $\frac{1}{2} \times \frac{1}{4}$  | 8. $\frac{3}{8} \times \frac{10}{12}$  |
| 2. $\frac{2}{3} \times \frac{3}{4}$  | 9. $\frac{4}{5}$ of $\frac{10}{11}$    |
| 3. $\frac{1}{8}$ of $\frac{4}{5}$    | 10. $1\frac{1}{2} \times 1\frac{1}{3}$ |
| 4. $\frac{5}{8}$ of $\frac{6}{7}$    | 11. $2\frac{1}{2} \times 1\frac{1}{5}$ |
| 5. $\frac{3}{4} \times \frac{5}{6}$  | 12. $2\frac{1}{4} \times 1\frac{1}{3}$ |
| 6. $\frac{5}{7} \times 1\frac{1}{5}$ | 13. $2\frac{1}{2} \times \frac{5}{8}$  |
| 7. $\frac{3}{8} \times \frac{4}{9}$  | 14. $\frac{7}{8}$ of $1\frac{2}{3}$    |

#### WRITTEN.

- |  |
|--|
| 36. $\frac{7}{8} \times \frac{16}{21} \times 1\frac{1}{2}$ |
| 37. $\frac{5}{8} \times \frac{12}{15} \times 3\frac{3}{4}$ |
| 38. $\frac{2}{10} \times 2\frac{5}{10} \times \frac{5}{9}$ |
| 39. $\frac{3}{8}$ of $1\frac{2}{3}$ of $2\frac{1}{2}$      |
| 40. $4\frac{1}{2} \times \frac{2}{3} \times 3\frac{5}{8}$  |
| 41. $6\frac{1}{4} \times 1\frac{3}{5} \times 7\frac{1}{2}$ |
| 42. $\frac{3}{4}$ of $\frac{4}{5}$ of $1\frac{1}{6}$       |
| 43. $\frac{5}{8} \times 6\frac{2}{3} \times \frac{7}{8}$   |
| 44. $\frac{2}{3}$ of $3\frac{3}{4} \times 1\frac{3}{5}$    |
| 45. $16 \times \frac{7}{8}$ of $8\frac{8}{9}$              |

**15 to 35.** Find the product of the fractions in Exercises 1 to 21, page 107.

**46.** What will  $\frac{5}{8}$  of a yard of silk cost at \$4 $\frac{1}{2}$  a yard?

Find the cost of

- 47.** 5 $\frac{1}{4}$  bushels of potatoes at \$.66 $\frac{2}{3}$  a bushel.  
**48.** 6 $\frac{2}{3}$  pounds of coffee at \$.33 $\frac{1}{3}$  a pound.  
**49.** 7 $\frac{2}{3}$  pounds of tea at \$.87 $\frac{1}{2}$  a pound.  
**50.** 1 $\frac{1}{2}$  cords of wood at \$6 $\frac{2}{3}$  a cord.  
**51.** 6 $\frac{2}{3}$  dozen hats at \$16 $\frac{1}{2}$  a dozen.



## DIVISION OF FRACTIONS.

**177. To divide a Fraction or a Mixed Number by an Integer.**

**Inductive Exercises.**—1. If I divide  $\frac{2}{3}$  of a dollar among 3 girls, what part of a dollar will each receive?

2.  $\frac{2}{3} \div 3 = ?$                       3. What is  $\frac{1}{3}$  of  $\frac{2}{3}$ ?

4. A mother divided  $\frac{1}{2}$  a pie among her 3 children. What part of the whole pie did each have?

5.  $\frac{1}{2} \div 3 = ?$                       6. What is  $\frac{1}{3}$  of  $\frac{1}{2}$ ?

7. How much is  $\frac{2}{3} \div 3$ ?  $\frac{2}{3}$  divided by 3?

*Solution.*— $\frac{2}{3} \div 3$  is the same as  $\frac{1}{3}$  of  $\frac{2}{3}$ , or  $\frac{2}{9}$ .

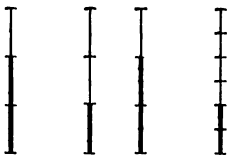
$\frac{2}{3} \div 3$  is the same as  $\frac{1}{3}$  of  $\frac{2}{3}$ , or  $\frac{2}{9}$ .

8. In dividing  $\frac{2}{3}$  by 3, which term of the fraction did we change? How did we change it? Did we change the *size* of the equal parts?

9. In dividing  $\frac{2}{3}$  by 3, which term did we change? How did we change it? Did we change the *size* of the equal parts? Did we change their number?

10. Show two methods of dividing  $\frac{2}{3}$  by 2.

ILLUSTRATION.



$\frac{2}{3} \div 2 = \frac{1}{3}$ , or  $\frac{2}{3} \times \frac{1}{2} = \frac{2}{6}$ , or  $\frac{1}{3}$

*Solution.*— $\frac{2}{3} \div 2$  is the same as  $\frac{1}{2}$  of  $\frac{2}{3}$ .  $\frac{1}{2}$  of 2 thirds is 1 third, or, multiplying the denominator,  $\frac{1}{2}$  of  $\frac{2}{3}$  is  $\frac{2}{6}$ , or  $\frac{1}{3}$ .

By the first process we *decrease* the number of equal parts while their size is not changed, and by the second process we *decrease* the *size* of the equal

parts while their number is unchanged. Hence,

**178.** A fraction is divided either by dividing its numerator or by multiplying its denominator.

**179. ORAL AND WRITTEN EXERCISES.**

1. Divide  $6\frac{2}{3}$  by 8.

1st Process.  $6\frac{2}{3} \div 8 = \frac{1}{8}$  of  $\frac{20}{3} = \frac{20}{24}$ , or  $\frac{5}{6}$ .

2d Process.  $6\frac{2}{3} \div 8 = \frac{1}{8} \times \frac{20}{3} = \frac{5}{6}$ .

*Solution.* — We first change the mixed number to an improper fraction.  $6\frac{2}{3} = \frac{20}{3}$ .  $\frac{1}{8}$  of  $\frac{20}{3}$  is  $\frac{20}{24}$ , or  $\frac{5}{6}$ . In the second process we shorten the work by cancellation.

2. Divide  $110\frac{2}{3}$  by 4.

$4 \overline{) 110\frac{2}{3}}$   
 $27\frac{2}{3}$  Ans.

$\frac{1}{4}$  of  $2\frac{2}{3} = \frac{1}{4}$  of  $\frac{8}{3}$ , or  $\frac{2}{3}$ . *Solution.* — When the mixed number is much larger than the divisor it is better to divide without changing the dividend to a fraction.  $\frac{1}{4}$  of  $110\frac{2}{3} = 27$ , and a remainder of  $2\frac{2}{3}$ .  $\frac{1}{4}$  of  $2\frac{2}{3}$  is  $\frac{2}{3}$ , which, united with 27, gives  $27\frac{2}{3}$ , Ans.

Find the quotient of

**ORAL.**

**WRITTEN.**

3. $\frac{3}{8} \div 4$	11. $\frac{5}{8} \div 10$	19. $\frac{24}{5} \div 16$	27. $119\frac{1}{2} \div 3$
4. $\frac{3}{4} \div 5$	12. $2\frac{1}{2} \div 5$	20. $\frac{30}{7} \div 45$	28. $107\frac{1}{4} \div 4$
5. $\frac{1}{5} \div 3$	13. $3\frac{2}{3} \div 9$	21. $8\frac{2}{5} \div 21$	29. $216\frac{1}{4} \div 5$
6. $\frac{3}{5} \div 3$	14. $4\frac{1}{2} \div 3$	22. $12\frac{1}{2} \div 5$	30. $328\frac{1}{2} \div 6$
7. $\frac{4}{9} \div 2$	15. $5\frac{1}{8} \div 4$	23. $33\frac{1}{8} \div 10$	31. $217\frac{3}{4} \div 7$
8. $\frac{3}{8} \div 6$	16. $7\frac{1}{2} \div 5$	24. $66\frac{2}{3} \div 25$	32. $641\frac{2}{3} \div 8$
9. $\frac{5}{8} \div 10$	17. $3\frac{1}{8} \div 5$	25. $87\frac{1}{2} \div 7$	33. $119\frac{2}{5} \div 9$
10. $\frac{11}{12} \div 3$	18. $6\frac{2}{3} \div 4$	26. $62\frac{1}{2} \div 5$	34. $621\frac{1}{2} \div 2$

**180. To divide by a Fraction or Mixed Number.**

**Inductive Exercises.**—1. How many fourths in 2?  
In 3? In 6?

2. How many times 1 fourth in 8 fourths?  $\frac{2}{4}$  in  $\frac{8}{4}$ ?

3. How many times 3 fourths in 12 fourths?  $\frac{3}{4}$  in  $\frac{12}{4}$ ?

4. Divide 5 by  $\frac{2}{4}$ .

*Solution.*—In 5 there are  $\frac{20}{4}$ .  $\frac{2}{4}$  in  $\frac{20}{4}$  as many times as 3 in 20, or  $6\frac{2}{3}$  times.  $6\frac{2}{3}$ , Ans.

5. How many times  $\frac{5}{8}$  in 4?

6. If one pair of gloves costs  $\$ \frac{2}{4}$ , how many pairs can be bought for  $\$ 2\frac{1}{4}$ ?

*Solution.*—As many pairs as  $\$ \frac{2}{4}$  is contained times in  $\$ 2\frac{1}{4}$ .  
 $\$ 2\frac{1}{4} = \$ \frac{9}{4}$ .  $\$ \frac{2}{4}$  in  $\$ \frac{9}{4}$  as many times as 3 in 9, or 3 times.  
Hence, 3 pairs can be bought.

7. How many times can a piece of ribbon  $\frac{3}{8}$  of a yard long be cut from one  $2\frac{5}{8}$  yards long?

8. Divide  $3\frac{3}{8}$  by  $\frac{3}{8}$ .

9.  $\$ \frac{1}{2}$  is how many times  $\$ \frac{1}{4}$ ?

10. How many times  $\frac{2}{4}$  in  $\frac{7}{8}$ ?

*Solution.*— $\frac{2}{4} = \frac{4}{8}$ ;  $\frac{4}{8}$  in  $\frac{7}{8}$ , as many times as 6 in 7, or  $1\frac{1}{8}$  times.

11. How many times  $\frac{2}{3}$  in  $\frac{8}{4}$ ?

*Solution.*— $\frac{2}{3} = \frac{8}{12}$ ;  $\frac{8}{4} = \frac{24}{12}$ .  $\frac{8}{12}$  in  $\frac{24}{12}$  as many times as 8 in 24, or  $3$  times.

12. How many times  $\frac{2}{3}$  in  $\frac{4}{6}$ ? 13.  $\frac{2}{3} \div \frac{4}{6} = ?$

14. Divide  $4\frac{1}{2}$  by  $2\frac{1}{3}$ .

*Solution.*— $4\frac{1}{2} = \frac{9}{2}$ , or  $\frac{27}{6}$ ;  $2\frac{1}{3} = \frac{4}{3}$ , or  $\frac{8}{6}$ .  $\frac{27}{6}$  in  $\frac{27}{6}$  as many times as 14 in 27, or  $1\frac{1}{2}$  times.

15. Divide  $1\frac{1}{2}$  by  $1\frac{1}{4}$ .

16. When do you change fractions to a common denominator before dividing?

17. What is the quotient of  $\frac{2}{3}$  divided by  $\frac{4}{5}$ ?

1st Process,  $\frac{2}{3} \div \frac{4}{5} = \frac{10}{15} \div \frac{12}{15} = \frac{10}{12}$ , or  $\frac{5}{6}$ , Ans.

2d Process,  $\frac{2}{3} \div \frac{4}{5} = \frac{2}{3} \times \frac{5}{4} = \frac{5}{6}$ , Ans.

*Solution.*— Changing both fractions to a common denominator, we have  $\frac{10}{15} \div \frac{12}{15}$ , which is the same as  $10 \div 12$ , or  $\frac{10}{12}$ , or  $\frac{5}{6}$ .

Or,  $\frac{2}{3} \div \frac{4}{5}$  is the same as  $\frac{2}{3} \div \frac{1}{\frac{5}{4}}$  of 4;  $\frac{2}{3} \div 4 = \frac{1}{4}$  of  $\frac{2}{3}$ , and  $\frac{2}{3} \div \frac{1}{4}$  of 4 =  $5 \times \frac{1}{4}$  of  $\frac{2}{3}$ , or  $\frac{5}{4}$  of  $\frac{2}{3}$ , or  $\frac{2}{3} \times \frac{5}{4}$ . Canceling and performing the multiplication, we have as before  $\frac{5}{6}$ , Ans. The second process is the same as multiplying the dividend by the divisor inverted.

18. Divide  $\frac{7}{8}$  by  $\frac{9}{10}$ .

19. Divide  $\frac{5}{6}$  by  $1\frac{1}{2}$ .

20. Divide 8 by  $2\frac{2}{3}$ .

21. Divide  $3\frac{1}{6}$  by  $9\frac{1}{2}$ .

$8 \div 2\frac{2}{3} = \frac{8}{1} \times \frac{3}{5} = 3$ , Ans.  $3\frac{1}{6} \div 9\frac{1}{2} = \frac{19}{6} \times \frac{2}{19} = \frac{1}{3}$ , Ans.

*Solution.*— In the preceding exercises we change the integer 8 to fractional form,  $\frac{8}{1}$  (Art. 139), and the mixed numbers to improper fractions, and proceed as before.

181. To divide by a fraction, —

*Change integers and mixed numbers to fractions; change fractions, if necessary, to fractions having a common denominator, and divide the numerator of the dividend by the numerator of the divisor. Or,*

*Invert the divisor, and proceed as in multiplication of fractions.*

**182. EXERCISES.****ORAL.**

Divide

1.  $\frac{1}{4}$  by  $\frac{1}{8}$
2.  $\frac{3}{4}$  by  $\frac{3}{8}$
3.  $\frac{5}{8}$  by  $\frac{5}{8}$
4. 5 by  $2\frac{1}{2}$
5. 7 by  $\frac{1}{8}$
6. 6 by  $\frac{1}{5}$
7.  $2\frac{1}{8}$  by 7
8.  $3\frac{1}{8}$  by 10
9.  $4\frac{1}{2}$  by 9
10.  $\frac{3}{4}$  by 6

11 to 36. Divide the first fraction by the second in Exercises 1 to 27, p. 107.

**WRITTEN.**

Divide

- |  |  |
|--|--|
| 37. $1\frac{1}{2}$ by $5\frac{1}{2}$   | 47. $9\frac{3}{8}$ by $4\frac{1}{2}$   |
| 38. $1\frac{5}{8}$ by $1\frac{3}{8}$   | 48. $2\frac{3}{8}$ by $1\frac{6}{8}$   |
| 39. $3\frac{1}{8}$ by $33\frac{1}{8}$  | 49. $5\frac{1}{2}$ by $38\frac{1}{2}$  |
| 40. $12\frac{1}{2}$ by $37\frac{1}{2}$ | 50. 75 by $12\frac{1}{2}$              |
| 41. $62\frac{1}{2}$ by $12\frac{1}{2}$ | 51. 100 by $33\frac{1}{3}$             |
| 42. $6\frac{1}{4}$ by 25               | 52. 100 by $87\frac{1}{2}$             |
| 43. 20 by $6\frac{2}{3}$               | 53. 100 by $14\frac{2}{7}$             |
| 44. $17\frac{1}{2}$ by $8\frac{1}{4}$  | 54. 12 by $\frac{4}{8}$                |
| 45. $18\frac{3}{4}$ by $9\frac{3}{8}$  | 55. $15\frac{3}{8}$ by $46\frac{4}{8}$ |
| 46. $21\frac{7}{8}$ by $5\frac{1}{2}$  | 56. 108 by $5\frac{1}{8}$              |
57. At \$.12 $\frac{1}{2}$  a pound how many pounds of sugar can be bought for \$2? At 8 $\frac{1}{8}$  cents?

Find the cost of

58. 1 pound of sugar when  $8\frac{1}{8}$  pounds cost \$1.
59. 1 yard of silk when  $2\frac{4}{5}$  yards cost \$6.
60. 1 barrel of apples when 7 barrels cost \$9 $\frac{5}{8}$ .
61. 1 quart of oil when  $4\frac{1}{2}$  quarts cost \$.67 $\frac{1}{2}$ .
62. 2 pounds of butter when 3 pounds cost \$.66 $\frac{3}{4}$ .
63.  $3\frac{1}{2}$  dozen spoons when 5 dozen cost \$24.
64. 7 acres of land when  $10\frac{1}{2}$  acres cost \$26 $\frac{1}{4}$ .
65.  $2\frac{3}{4}$  pounds of meat when  $5\frac{1}{2}$  pounds cost \$1.65.
66.  $1\frac{7}{8}$  gallons of alcohol when  $3\frac{3}{4}$  gallons cost \$9 $\frac{3}{8}$ .
67. 7 lead pencils at \$1 a dozen.

**183. To find a Number when a Part of it is given.****ORAL EXERCISES.**

1. Edward spent \$2, which was  $\frac{1}{2}$  of his money  
How much had he at first? 2 is  $\frac{1}{2}$  of what number?

2. 3 is  $\frac{1}{2}$  of what number?  $\frac{1}{3}$  of what number?

3. 4 years is  $\frac{1}{2}$  of Mary's age; how old is she?

4. 4 is  $\frac{1}{3}$  of what number? What is  $\frac{1}{3}$  of 12?

5. What is  $\frac{1}{5}$  of 15? 3 is  $\frac{1}{5}$  of what number?

6. What is  $\frac{1}{4}$  of 8?  $\frac{3}{4}$  of 8?

7. 6 is  $\frac{3}{4}$  of what number?

*Solution.* — As 6 is 3 fourths of some number, 1 fourth of the number is  $\frac{1}{3}$  of 6, or 2, and 4 fourths of the number are  $4 \times 2$ , or 8. Hence 6 is  $\frac{3}{4}$  of 8.

8. 6 is  $\frac{3}{8}$  of what number?

9. Nathan gave 8 pears, or  $\frac{2}{3}$  of all he had, to his sister. How many had he at first?

10. 10 is  $\frac{2}{3}$  of what number? 11.  $\frac{5}{8}$  of what number?

12. 12 is  $\frac{3}{4}$  of what number? 13.  $\frac{4}{5}$  of what number?

14. 15 is  $\frac{5}{6}$  of what number? 15.  $\frac{3}{8}$  of what number?

16. 18 is  $\frac{3}{5}$  of what number? 17. What is  $\frac{2}{3}$  of 45?

18. 18 is  $\frac{3}{8}$  of what number? 19.  $\frac{3}{8}$  of 48 = ?

20. 24 is  $\frac{4}{5}$  of what number? 21.  $\frac{3}{8}$  of what number?

22. 24 is  $\frac{3}{5}$  of what number? 23.  $\frac{4}{7}$  of what number?

24. A man spent  $\frac{2}{3}$  of his money; what part had he left? If he had \$10 left, how much had he at first?

25. \$10 is  $\frac{1}{3}$  of how much money?

26. A man spent \$20, or  $\frac{2}{3}$  of his money. How much had he?

**184. To find what part One Number is of Another.****ORAL EXERCISES.**

1. 1 is what part of 2?    2. 2 is what part of 4?
3. 3 is what part of 6?    4. 2 is what part of 6?
5. 12 is how many times 4?
6. 4 is what part of 12?
7. What is  $\frac{2}{3}$  of 12?    8. 8 is what part of 12?
9. 8 is  $\frac{2}{3}$  of what number?
10. Having \$15, I spent \$10; what part of my money did I spend? What part had I left?

*Solution.* — I spent  $\frac{10}{15}$ , or  $\frac{2}{3}$ , of my money; and I had the difference between  $\frac{2}{3}$  and  $\frac{2}{3}$ , or  $\frac{1}{3}$  of my money left.

11. 16 is what part of 24?    12. Of 20?
13. A day is what part of a week? 3 days?
14. 15 is what part of 60?    15. 20 is what part?
16. What part of an hour is 15 minutes? 20 minutes?
17. What part of a pound is 8 ounces? 12 ounces?
18. What part of a year is 3 months? 9 months?
19. What part of a day is 12 hours? 18 hours?
20. What part of a ream is 5 quires? 15 quires?
21. 25 is what part of 100? 75 is what part?
22. What part of 100 is  $33\frac{1}{3}$ ?  $66\frac{2}{3}$ ?
23. What part of a bushel is 3 pecks? 8 quarts?
24. A man bought 36 acres of land and sold 12 acres. What part of his farm had he left?

## REVIEW.

## 185. ORAL EXERCISES.

1. James has  $\$4\frac{1}{2}$  in 50-cent pieces; how many has he?
2. How many quarter dollars in  $\$3\frac{3}{4}$ ?
3. In  $4\frac{3}{8}$  days how many days?
4. A man bought  $\frac{2}{3}$  of a yard of cloth, and sold  $\frac{3}{4}$  of a yard. How much had he left?
5. In  $\frac{3}{4}$  of a dollar how many cents?
6. If  $\frac{1}{2}$  a pound of coffee costs \$.25, what will 2 pounds cost?
7. Henry's father gave him \$2 to spend on the Fourth of July. He gave  $\frac{1}{2}$  of it for a pistol,  $\frac{1}{4}$  of it for fire-crackers, and  $\frac{1}{8}$  of it for torpedoes; what part had he left?
8. If a quarter-note in music has half a beat, how many beats has a whole note?
9. From a piece of broadcloth 6 yards long  $3\frac{3}{4}$  yards were sold at one time and  $\frac{3}{4}$  of a yard at another. How many yards were left?
10. What will  $2\frac{3}{8}$  pounds of steak cost at \$.24 a pound?
11. Change  $\frac{2}{3}\frac{7}{4}$  to smallest terms.
12. Loring was sent to the store for 2 dozen eggs, but on his way home he fell and broke  $\frac{3}{8}$  of them. How many had he left?



13. What sum will pay for 3 days' board at  $\$4\frac{1}{5}$  a week?

14.  $\$56$  is  $\frac{7}{8}$  of my money. How much have I?

15. How many cents in  $\frac{1}{3}$  of a dollar? In  $\frac{2}{3}$ ?

16.  $3\frac{1}{2}$  is the minuend and  $\frac{3}{4}$  the subtrahend. What is the remainder?

17. I had a fishing-rod in 3 pieces. One measured  $4\frac{1}{2}$  feet, another  $4\frac{3}{4}$  feet, and the third  $5\frac{3}{4}$  feet. How long was the rod?

18. What will  $\frac{3}{4}$  of a ream of paper cost at 10 cents a quire?

19. What will 3 writing-books cost at  $\$1$  a dozen?

20. In how many hours can you walk 9 miles at the rate of  $2\frac{1}{4}$  miles an hour?

( 21. Mr. Low sold a cow for  $\$48$ .  $\frac{3}{8}$  of this was gain. How much was gain? What was the cost?

( 22.  $\frac{5}{9}$  of my money is in gold. How much money have I in all if I have  $\$25$  in gold?

( 23. Ann worked  $\frac{2}{3}$  of an hour at  $\$.37\frac{1}{2}$  an hour. How much must she be paid? \

24. In a school of 48 scholars  $\frac{5}{8}$  are girls. How many boys are there?

25. What will a peck of onions cost at  $\$2\frac{2}{3}$  a bushel?

26. Find the quotient of  $\frac{5}{8} \div \frac{3}{8}$ .

27. A teacher gave each of her 45 pupils, on Christmas, a box of candy holding  $\frac{1}{8}$  of a pound. How many pounds did she buy?

28. How many dresses can be made from a piece of calico containing 33 yards if  $5\frac{1}{2}$  yards make 1 dress?

29. What is the distance around one side of this book if it is  $7\frac{1}{8}$  inches long and  $3\frac{7}{8}$  inches wide?

30. If  $2\frac{1}{2}$  yards cost \$5, what will  $7\frac{1}{2}$  yards cost?

31. A man must dig his well 35 feet deep to reach water. He has already dug  $18\frac{3}{4}$  feet. How much farther must he dig?

32. What is the rent of a house for a month if it is \$200 for a year?

33. When the baby was born he weighed  $9\frac{1}{2}$  pounds. At the end of four weeks he weighed 14 pounds. How much did he gain a week?

34. Etta has the month of June for her vacation. She stays  $\frac{2}{3}$  of the time with her aunt, and the rest of the time with her grandmother. How many days does she spend with her grandmother?

35. A newsboy has 30 customers. He carries daily papers, and makes  $\frac{3}{4}$  of a cent on each one. How much does he make a week?

36. In June my gas cost me \$6, which was  $\frac{3}{4}$  of what it cost in May, and  $\frac{1}{2}$  of what it cost in April. How much did I pay for gas for the three months?

37. How many trips can a horse-car make in 12 hours if it takes  $1\frac{1}{2}$  hours to make one trip?

38. What part of a day do you spend in school? Of a week?

39. A man went to China when he was 18 years old, and returned at the age of 45. What part of his life was spent in China ?

40. Mr. Lane was to have  $\frac{1}{3}$  of all he dug to pay him for digging my crop of potatoes. If his share was 8 bushels, what was mine ?

41. If  $3\frac{1}{2}$  yards cost \$10, what will  $\frac{2}{3}$  of a yard cost ?

42. Jennie is  $\frac{1}{7}$  as old as her mother. If Jennie is  $7\frac{1}{2}$  years old, how old is her mother ?

43.  $\frac{2}{3}$  of 48 is how many times 9 ?

44. 72 is  $\frac{8}{9}$  of how many times 9 ?

45. What part of a day is 15 hours ?

46. I leave home at half-past seven and travel  $6\frac{3}{4}$  hours. At what hour do I reach the end of my journey ?

47. What is half the difference between  $7\frac{5}{8}$  and  $9\frac{3}{4}$  ?

48. How much more is  $6 \div \frac{1}{5}$  than  $7 \div \frac{1}{4}$  ?

49. What number multiplied by  $4\frac{1}{2}$  equals 27 ?

50.  $\frac{5}{8}$  of 48 is  $\frac{4}{5}$  of what number ?

51. A farmer paid \$ $3\frac{3}{8}$  for shoeing two yoke of oxen. What did he pay for shoeing each ox ?

52. If  $\frac{2}{3}$  of a dozen bananas cost 40 cents, what will  $\frac{5}{8}$  of a dozen cost ?

53. Of a farmer's stock of poultry  $\frac{2}{3}$  are chickens,  $\frac{1}{6}$  are geese,  $\frac{1}{4}$  are ducks, and the remaining 15 are turkeys. How many of each kind has he ?

54. If  $10\frac{1}{4}$  bushels of oats will feed a span of horses 2 weeks, how many bushels will feed 9 horses for the same time ?

**186. WRITTEN EXERCISES.**

1. How many days in  $\frac{4}{5}$  of a common year?
2. At \$15 a week what is my board bill for  $7\frac{1}{4}$  weeks?
3. In  $\frac{5}{8}$  of a dollar how many cents?
4. At \$2.66 $\frac{2}{3}$  a day, how much can a man earn in a week?
5. A clerk has a salary of \$1000. He saves  $\frac{3}{8}$  of it. What does he spend a month?
6. How many hours in  $365\frac{1}{4}$  days?
7. What must be paid for  $36\frac{3}{4}$  days' work at \$1.50 a day?
8. Find the value of  $(17\frac{3}{5} + 19\frac{1}{4}) - 12\frac{7}{10}$ .
9. How many tons of hay may be bought for \$183 $\frac{3}{4}$  at \$15 a ton?
10. Change  $\frac{85427}{48}$  to a mixed number.
11. \$164.75 was  $\frac{5}{8}$  of a merchant's sales for one day. What were the total sales?
12. Mr. Slack owed me \$218.25, but could pay only  $\frac{1}{2}\frac{1}{5}$  of it. How much was unpaid?
13. What must I pay for 236 pounds of paper stock at \$0.02 $\frac{1}{8}$  a pound?
14. What is the weight of 165 boxes of soap at an average weight of  $16\frac{3}{4}$  pounds a box?
15.  $\frac{2}{5}$  of my money is in the savings bank,  $\frac{3}{10}$  of it is in my safe, and the remainder, or \$225, is in my pocket. How much have I?

16. Bought 25 pounds of sugar at the rate of 12 pounds for \$1. What was my bill?

17. If  $7\frac{1}{2}$  barrels of apples cost \$30, what will 45 barrels cost?

18. Captain Jones owned  $\frac{3}{4}$  of a ship, but sold  $\frac{1}{8}$  of his share to the first mate for \$15000. What was the whole ship worth?

19. Add  $5\frac{5}{8}$ ,  $17\frac{11}{12}$ ,  $4\frac{1}{2}$ , and  $16\frac{3}{4}$ .

20. A milkman sold 268 gallons of milk in a week at \$.07 $\frac{3}{4}$  a quart. How much did he receive?

21. Make out and receipt Mr. Brown's bill. He buys of you  $8\frac{1}{4}$  pounds of steak, at 25¢, 25 pounds of sugar at 12 $\frac{1}{2}$ ¢, and a turkey weighing  $9\frac{3}{4}$  pounds, at 18¢.

22. What will  $\frac{3}{4}$  of a pound of opium cost at \$13.50 a pound?

23. If you sell your teacher  $\frac{7}{12}$  of a dozen collars at \$3.50 a dozen, what must she pay you?

24. The quotient is  $8\frac{2}{5}$ , the divisor  $3\frac{1}{7}$ . Find the dividend.

25. Boston is 234 miles from New York. How fast must a train run to make the distance in  $5\frac{3}{4}$  hours?

26. A schooner laden with 596 tons of coal threw  $\frac{3}{16}$  of her cargo overboard in a storm. How many tons did she bring into port?

27. H. M. Moore & Co. sell Everett Hixon  $\frac{2}{3}$  dozen hats at \$16.50 a dozen,  $\frac{3}{4}$  dozen at \$7.50 a dozen, and  $\frac{5}{12}$  dozen at \$6. Make out their bill.

28. \$140 is  $\frac{8}{15}$  of what sum?

Find the cost of

- ( 29.  $6\frac{7}{8}$  tons of coal at \$6.25 a ton.
- ( 30. 215 pounds of rice at \$9.50 for 150 pounds.
- ( 31.  $\frac{3}{4}$  of a yard of silk when  $\frac{7}{8}$  yard cost \$3.50.
- ( 32.  $42\frac{7}{8}$  yards of carpet at \$2.25 per yard.
- ( 33. 1715 pounds of cotton at \$.11 $\frac{1}{4}$  a pound.
- ( 34. 1 roll of paper containing 8 yards, at 16 $\frac{2}{3}$  cts.
- 35. It is 3317 miles from New York to San Francisco. If you travel 30 miles an hour, how many days and hours will the journey between the two cities require?
- ( 36. What will 16 $\frac{2}{3}$  pounds of meat cost at \$.16 $\frac{2}{3}$  a pound?
- 37. Mr. Mason bought a piano for \$350, and sold it for  $\frac{5}{6}$  of the cost. What did he lose?
- 38. My crop of apples this year is 132 bushels. How many barrels shall I need to hold them if one barrel holds 2 $\frac{3}{4}$  bushels?
- 39. If 6 men can build a house in 24 $\frac{1}{2}$  days, how many days will 15 men require?
- ( 40. The crew of a boat weigh 162 $\frac{3}{4}$ , 157 $\frac{5}{8}$ , 169 $\frac{1}{2}$ , and 151 $\frac{1}{8}$  pounds respectively. The coxswain weighs 87 $\frac{3}{4}$  pounds. What is the entire weight?
- 41. A merchant sold 7 $\frac{3}{8}$  yards of silk to one lady and 8 $\frac{1}{2}$  yards to another. What did he receive for the whole at \$4.75 a yard?
- 42. How many pounds of tea at \$ $\frac{3}{4}$  a pound can be bought for 7 quarter-eagles?
- 43. What will 2 $\frac{1}{8}$  yards of ribbon cost at \$ $\frac{3}{8}$  a yard?

Find the cost of

44.  $\frac{3}{4}$  of a yard of cassimere at \$1.37 $\frac{1}{2}$  a yard.
45. 1 yard of carpet when 8 $\frac{3}{4}$  yards cost \$14.
46.  $1\frac{1}{2}$  of a dozen hose at \$4.50 a dozen.
47. 64 sheets of drawing paper at \$.80 a quire.
48. 17 $\frac{1}{2}$  pounds of grapes at \$.16 $\frac{2}{3}$  a pound.
49. A merchant gained \$750 in 2 $\frac{1}{2}$  months. At that rate what were his profits for a year? -
50. If a cubic foot of coal weighs 80 $\frac{1}{2}$  pounds, how many cubic feet are there in a ton?
51. What part of a common year equals 215 days?
52.  $\frac{4}{5}$  of the value of my house is  $\frac{3}{4}$  of the value of my neighbor's. If mine is worth \$4500, what is his worth?
53. Take the sum of 17 $\frac{2}{3}$  and 3 $\frac{1}{6}$  from their product.
54. A gentleman willed  $\frac{1}{4}$  his property to his wife,  $\frac{2}{3}$  of the remainder to his son, and what was left to his daughter. The wife received \$6000. What did the others have?
55. Ella has a vase to draw 2 $\frac{1}{2}$  times as large as the copy. If the copy is 3 $\frac{5}{8}$  inches long and 1 $\frac{2}{8}$  inches wide, what will her drawing measure?
56. If one of your steps measures 2 $\frac{1}{4}$  feet, how many steps will you take in walking a mile, or 5280 feet?
57. If  $\frac{3}{5}$  of a barrel of flour costs \$3.90, how many barrels can be bought for \$71 $\frac{1}{2}$ ?
58. What will 56 buttons cost at \$0.62 $\frac{1}{2}$  a dozen?
59. If 19 eggs weigh 2 pounds, what will 6 $\frac{1}{2}$  dozen weigh?

60. A gentleman leaves home at 8.35 A.M., and is gone  $8\frac{1}{2}$  hours. At what time does he return?

61. If 8 of these books weigh 3 pounds, how many of them will weigh a ton?

62. The ice on a pond was  $2\frac{3}{8}$  inches thick at the end of the year. If it formed at the rate of  $\frac{2}{16}$  of an inch each day, how thick was it February 1st?

### 187. QUESTIONS.

132. What is a fraction? 135. What does the denominator show? 136. The numerator? 142. What is the value of a fraction? 143. Reduction of fractions? 145. How do you change a mixed number to a fraction? 148. Define common divisor. 149. When is a fraction in its smallest terms? 150, 153. What changes may be made in the terms of a fraction without changing its value? Why? 157. What is a common multiple?

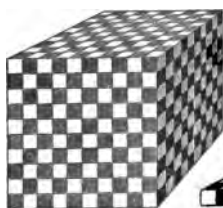
158. When is the least common multiple used? 160. What are like fractions? 161. How do you add fractions? 162. Mixed numbers? 165. How do you find the difference between two fractions? 170. How is a fraction multiplied? Why? 171. Define cancellation. 173. How do you multiply a mixed number by an integer? 175. How do you multiply a fraction by a fraction?

178. How is a fraction divided? 177. Show that multiplying the denominator divides the fraction. 181. How do you divide by a fraction? Which is the better way of multiplying  $\frac{3}{8}$  by 2? Why? 170. To what is the word *of* equivalent in multiplication of fractions? Show what is meant by  $\frac{5}{8}$ . What is the difference between multiplying by 2 and dividing by  $\frac{1}{2}$ ? Illustrate. What is the difference between dividing by 3 and multiplying by  $\frac{1}{3}$ ? Illustrate. Does a large denominator necessarily mean a large fraction? Is  $\frac{14}{141}$  a large or a small fraction? Why? Name a large fraction.



## DECIMALS.

**188. Inductive Exercises.**—1. If a block is divided into 10 equal parts, what is each part called?



A Unit or One.  
1 or 1.0

2. What is  $\frac{1}{10}$  of 1? How many tenths in 1?



One Tenth.  
 $\frac{1}{10}$  or 0.1



One Hundredth  
 $\frac{1}{100}$  or 0.01



One Thousandth  
 $\frac{1}{1000}$  or 0.001

3. If 1 tenth of a block is divided into 10 equal parts, what is each part called?

4. What is  $\frac{1}{10}$  of  $\frac{1}{10}$ ? How many hundredths in 1?

5. If 1 hundredth of a block is divided into 10 equal parts, what is one part called?

6. What is  $\frac{1}{10}$  of  $\frac{1}{100}$ ? How many thousandths in 1?

7. How many hundredths in 1 tenth?

8. How many thousandths in 1 hundredth?

9. What part of 1 tenth is 1 hundredth?

10. What part of 1 hundredth is 1 thousandth?

**189. A Decimal Fraction** is a fraction whose unit is divided into *tenths*, *hundredths*, *thousandths*, etc. Thus,  $\frac{7}{10}$ ,  $\frac{54}{100}$ ,  $\frac{116}{1000}$ ,  $\frac{284}{10000}$  are decimal fractions.

**190.** Decimal fractions are usually written without their denominators, by means of the decimal point, and are then called *Decimals*. (Art. 19.) Thus:

$\frac{5}{10}$	is written	0.5	$\frac{75}{1000}$	is written	0.075
$\frac{5}{100}$	"	0.05	$\frac{375}{1000}$	"	0.375
$\frac{75}{100}$	"	0.75	$\frac{251}{10000}$	"	0.0251

It will be seen from these examples that each decimal figure represents a cipher in the denominator.

**191.** The **Denominator** of a decimal is always 1, with as many ciphers annexed as there are figures in the decimal.

**192.** A **Mixed Decimal** is an integer and a decimal. As 14.25; 18.175; \$ 21.76.

**193.** The table showing the orders of units (Art. 25) may be extended still farther to the right, as follows:—

TABLE											
ORDERS OF UNITS	6th.	5th.	4th.	3d.	2d.	1st.	.	1st.	2d.	3d.	4th.
	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths	Thousandths	Ten-thousandths
PLACE-NAMES.											
FIGURES	7	9	3	1	5	4	.	6	3	8	4
GROUPS	2d,			1st,				1st Decimal,			2d Decimal,
GROUP-NAMES	Thousands,			Ones,				Thousandths,			Millionths

The number in the table is read, seven hundred ninety-three thousand one hundred fifty-four, and six hundred thirty-eight thousand four hundred eight *millionths*.

**194. EXERCISES.**

Read the following decimals (Arts. 27; 21, note).

1. 0.8	8. 0.005	15. 3.147	22. 14.003
2. 4.9	9. 0.015	16. 0.6491	23. 1.2005
3. 0.07	10. 2.007	17. 0.0842	24. 0.00008
4. 2.19	11. 3.476	18. 3.0091	25. 0.00347
5. 1.05	12. 0.849	19. 5.0006	26. 6.29041
6. 0.05	13. 1.505	20. 0.39	27. 3.47675
7. 0.87	14. 2.650	21. 0.039	28. 8.462943

Write as decimals, —

29. $\frac{8}{10}$	33. $\frac{15}{1000}$	37. $6\frac{4}{100}$	41. \$ $3\frac{15}{100}$
30. $\frac{8}{100}$	34. $\frac{6}{1000}$	38. $7\frac{15}{100}$	42. \$ $8\frac{425}{1000}$
31. $\frac{18}{100}$	35. $\frac{218}{100}$	39. $2\frac{24}{1000}$	43. \$ $6\frac{2}{100}$
32. $\frac{155}{1000}$	36. $\frac{875}{10000}$	40. $5\frac{285}{10000}$	44. \$ $7\frac{5}{1000}$

45. Four hundred nine thousandths.
46. Sixteen and seven hundredths.
47. Sixty-four, and seventy-eight thousandths.
48. Nine hundred forty-one, and seven ten-thousandths.
49. Three hundred nine hundred-thousandths.
50. Four hundred four thousandths.
51. Four hundred, and four thousandths.
52. Six hundred thousandths.
53. Six hundred-thousandths.
54. One thousand two hundred eight millionths.
55. Thirty thousand thirty hundred-thousandths.

## REDUCTION OF DECIMALS.

**195. To change a Decimal to Higher or Lower Terms.**

**Inductive Exercises.** — 1. 0.6 are how many hundredths?

2. 0.60 are how many thousandths?

3. If  $0.6 = 0.60$  and  $0.60 = 0.600$ , what effect has annexing a cipher to a decimal?

4. 0.500 are how many hundredths?

5. 0.50 are how many tenths?

6. If  $0.500 = 0.50$ , and  $0.50 = 0.5$ , what effect has removing a cipher from the right of a decimal?

**196.** *Annexing ciphers to a decimal, or removing ciphers from the right of a decimal, does not change its value.* Hence we may change decimals to higher or lower terms by annexing, or dropping from the right, as many ciphers as necessary.

Change

7. 0.400 to tenths.

10. 5.6400 to hundredths.

8. 0.96 to thousandths.

11. 0.5 to millionths.

9. 0.4 to ten-thousandths.

12. 8.34 to ten-thousandths.

**197. To change a Decimal to a Common Fraction.**

**Inductive Exercises.** — 1. What is the denominator of 0.5? Of 0.25? Of 0.125? Of 0.0750?

2. Change  $\frac{5}{10}$  to halves.

4.  $\frac{125}{1000}$  to eighths.

3.  $\frac{25}{100}$  to fourths.

5. 0.0750 to smallest terms.

## WRITTEN EXERCISES.

1. Change 0.125 to a common fraction in smallest terms.

$0.125 = \frac{125}{1000} = \frac{1}{8}$ , Ans. *Solution.*—0.125 may be written  $\frac{125}{1000}$ , which, changed to its smallest terms (Art. 151), is  $\frac{1}{8}$ , Ans. Hence,

**198.** To change a decimal to a common fraction, —

*Write the denominator, erase the decimal point, and then change the fraction to its smallest terms.*

Change to common fractions, —

2. 0.125      6. 0.625      10. 0.9375      14. 0.3125

3. 0.60      7. 0.875      11. 0.025      15. 0.6875

4. 0.375      8. 0.064      12. 0.48      16. 0.1875

5. 0.0025      9. 0.8125      13. 0.0375      17. 0.0960

**18.** Change  $0.16\frac{2}{3}$  to a common fraction.

*Solution.* —  $0.16\frac{2}{3} = \frac{16\frac{2}{3}}{100}$ , or  $\frac{1}{100}$  of  $16\frac{2}{3} = \frac{1}{100} \times \frac{50}{3} = \frac{1}{6}$ , Ans.

**NOTE.** A decimal with a common fraction is a *complex decimal*.

Change to common fractions: —

19.  $0.06\frac{1}{4}$       20.  $0.08\frac{1}{3}$       21.  $0.33\frac{1}{3}$       22.  $0.66\frac{2}{3}$

**199.** To change a Common Fraction to a Decimal.

**Inductive Exercises.** — 1. How many tenths in 1? In  $\frac{1}{2}$ ?

2. How many hundredths in 1? In  $\frac{1}{4}$ ? In  $\frac{3}{4}$ ?

3. In a dollar how many hundredths? In  $\$ \frac{1}{2}$ ?

4. In a dollar how many thousandths? In  $\$ \frac{1}{4}$ ?  
In  $\$ \frac{1}{8}$ ?

## WRITTEN EXERCISES.

1. Change
- $\frac{3}{8}$
- to a decimal.

$$\begin{array}{r} 8 \overline{) 3.000} \\ \underline{0.375} \end{array}$$

*Solution.* —  $\frac{3}{8}$  is the same as  $\frac{1}{3}$  of 3; 3 is the same as 3.000, and  $\frac{1}{3}$  of 3.000, found by dividing in the usual way, is 0.375, Ans. Hence,

200. To change a common fraction to a decimal, —

*Annex to the numerator as many decimal ciphers as may be required, and then divide by the denominator.*

**NOTE.** The sign + may be used in the quotient after enough decimal places have been found to show that the division is incomplete, or, if exactness is required, the quotient may be in the form of a complex decimal. Thus,  $\frac{3}{8}$ , changed to a decimal of three places, is 0.666+, or 0.666 $\frac{1}{2}$ .

Change the following fractions to decimals:—

- |                    |                    |                      |                    |                     |
|--------------------|--------------------|----------------------|--------------------|---------------------|
| 2. $\frac{5}{8}$   | 7. $\frac{3}{125}$ | 12. $\frac{12}{125}$ | 17. $\frac{3}{40}$ | 22. $\frac{1}{12}$  |
| 3. $\frac{7}{8}$   | 8. $\frac{15}{16}$ | 13. $\frac{6}{25}$   | 18. $\frac{5}{12}$ | 23. $\frac{5}{7}$   |
| 4. $\frac{1}{25}$  | 9. $\frac{8}{25}$  | 14. $\frac{4}{9}$    | 19. $\frac{3}{16}$ | 24. $6\frac{2}{8}$  |
| 5. $\frac{3}{4}$   | 10. $\frac{2}{6}$  | 15. $\frac{1}{3}$    | 20. $\frac{5}{6}$  | 25. $7\frac{1}{40}$ |
| 6. $\frac{17}{20}$ | 11. $\frac{1}{40}$ | 16. $\frac{5}{16}$   | 21. $\frac{1}{6}$  | 26. $8\frac{2}{25}$ |

201. Computations are frequently much shortened by the use of the following

## Fractional Parts of a Dollar.

$\$0.06\frac{1}{4} = \$\frac{1}{16}$	$\$0.16\frac{2}{3} = \$\frac{1}{6}$	$\$0.37\frac{1}{2} = \$\frac{3}{8}$	$\$0.66\frac{2}{3} = \$\frac{2}{3}$
$\$0.08\frac{1}{3} = \$\frac{1}{12}$	$\$0.25 = \$\frac{1}{4}$	$\$0.50 = \$\frac{1}{2}$	$\$0.75 = \$\frac{3}{4}$
$\$0.12\frac{1}{2} = \$\frac{1}{8}$	$\$0.33\frac{1}{3} = \$\frac{1}{3}$	$\$0.62\frac{1}{2} = \$\frac{5}{8}$	$\$0.87\frac{1}{2} = \$\frac{7}{8}$

**NOTE.** This table should be committed to memory.

**202. ORAL EXERCISES.**

1. What will 42 pounds of raisins cost at  $\$0.16\frac{2}{3}$  a pound?

*Solution.*  $\$0.16\frac{2}{3} = \frac{1}{3}$  of a dollar. At  $\$1$  a pound, 42 pounds cost  $\$42$ ; at  $\frac{1}{3}$  a pound, the cost of 42 pounds is  $\frac{1}{3}$  of  $\$42$ , or  $\$7$ , Ans.

2. What will 24 yards of muslin cost at  $\$0.87\frac{1}{2}$  a yard?

*Solution.*  $\$0.87\frac{1}{2} = \frac{7}{8}$  of a dollar. At  $\$1$  a yard, 24 yards cost  $\$24$ ; at  $\frac{7}{8}$  a yard, the cost of 24 yards is  $\frac{7}{8}$  of  $\$24$ , or  $\$21$ , Ans.

3. What will 27 yards of gingham cost at  $33\frac{1}{3}$  cents a yard?

4. Bought a firkin of butter weighing 56 pounds at  $\$0.37\frac{1}{2}$  a pound. Required the cost.

5. A grocer sold 96 barrels of flour in a week, and made  $\$0.62\frac{1}{2}$  profit on each barrel. What were his profits for the week?

6. What shall I pay for  $2\frac{1}{2}$  pounds of steak at  $\$0.33\frac{1}{3}$  a pound?

Find the cost of

7. 40 yards of matting at  $\$0.62\frac{1}{2}$  a yard.
8. 60 pounds of tea at  $\$0.66\frac{2}{3}$  a pound.
9. 42 gallons of kerosene at  $\$0.12\frac{1}{2}$  a gallon.
10. 72 bushels of oats at  $\$0.37\frac{1}{2}$  a bushel.
11. 60 pounds of rice at  $\$0.08\frac{1}{3}$  a pound.
12. 32 yards of lace at  $\$0.87\frac{1}{2}$  a yard.
13. 480 pounds of cheese at  $\$0.16\frac{2}{3}$  a pound.

## ADDITION AND SUBTRACTION OF DECIMALS.

**203.** Decimals are added and subtracted in all respects like integers, as has already been seen.

Care should be taken to write the decimal point as soon as tenths are added or subtracted.

It is sometimes necessary to make the number of decimal places in the minuend and subtrahend equal, by annexing ciphers, as in Exercises 12 and 13 below.

Add

	1.	2.	3.	4.	5.
6.	4.75	84.68	6.49	81.94	84.96
7.	6.825	9.214	0.82	0.063	3.942
8.	0.942	8.432	0.8341	75.	0.076
9.	6.784	.075	8.194	0.849	81.003
10.	<u>3.98</u>	<u>3.5</u>	<u>6.834</u>	<u>0.2831</u>	<u>6.2</u>

NOTE. For Exercises 6 to 10, take the numbers in the lines across the page.

	11.	12.	13.	14.	15.
From	8.46	13.4	18.347	9.468	0.183
take	<u>1.98</u>	<u>1.875</u>	<u>9.46</u>	<u>0.4391</u>	<u>0.0976</u>

16. From 86 and 4 *tenths* take 127 *thousandths*.

17. From 2 and 7 *hundredths* take 1 and 6 *tenths*.

18. From 9000 take 127 *ten-thousandths*.

19. Find the sum of all the minuends on this page.

20. Find the sum of all the subtrahends on this page.

21.  $(9.84 + 0.476) - 0.3789 = ?$



MULTIPLICATION OF DECIMALS.

**204. Inductive Exercises.** — 1. What is 3 times  $\frac{2}{10}$ ?  
4 times 0.2? 6 times 0.3? 8 times 0.7?

2. What is  $\frac{1}{10}$  of  $\frac{1}{10}$ ?  $0.1 \times 0.1$ ?  $0.3 \times 0.3$ ?

3. What is 4 times  $\frac{2}{100}$ ? 5 times 0.12?  $3 \times 0.09$ ?

4. What is  $\frac{1}{100}$  of  $\frac{1}{10}$ ?  $0.01 \times 0.1$ ?  $0.06 \times 0.4$ ?

5. Tenths multiplied by tenths give what? How many decimal places are required in writing hundredths?

6. In the product of hundredths by tenths how many decimal places are there?

7. What is the product of 0.48 multiplied by 0.6?

0.48

0.6

0.288, Ans.

*Solution.* — 0.48 may be written  $\frac{48}{100}$ . 0.6 may be written  $\frac{6}{10}$ .  $\frac{48}{100} \times \frac{6}{10} = \frac{288}{1000}$ , which written decimally is 0.288, Ans. Hence,

**205.** To multiply in decimals, —

*Multiply as in integers, and point off as many decimal figures in the product as there are decimal figures in both factors.*

NOTE 1. If there are not figures enough in the product, supply the deficiency by prefixing ciphers.

2. To multiply a decimal by 10, 100, &c., move the decimal point to the right as many places as there are ciphers in the multiplier. (Art. 86.)

8. Find the product of 2.45 multiplied by 0.8.

9. Multiply 4.68 by 2.5.

10. 0.864 by 0.25.

11. Multiply 0.064 by 850.

12. 6.96 by 9.6.

13. Multiply 29.85 by 0.09.

14. 56.2 by 1.5.

**206. WRITTEN EXERCISES.****Multiply**

- |                          |                                       |
|--------------------------|---------------------------------------|
| <b>1.</b> 2.25 by 0.8    | <b>13.</b> 8.75 by 10                 |
| <b>2.</b> 64.8 by 1.25   | <b>14.</b> 0.005 by 0.37              |
| <b>3.</b> 0.486 by 0.35  | <b>15.</b> 0.384 by 29                |
| <b>4.</b> 278 by 0.15    | <b>16.</b> 68.4 by 7.4                |
| <b>5.</b> 34.5 by 0.625. | <b>17.</b> 17.28 by $0.08\frac{1}{8}$ |
| <b>6.</b> 0.486 by 3.25  | <b>18.</b> 0.09 by 1.09               |
| <b>7.</b> 84.9 by 6.48   | <b>19.</b> 8.75 by 3.6.               |
| <b>8.</b> 0.025 by 0.005 | <b>20.</b> 0.34 by 0.34               |
| <b>9.</b> 105.72 by 100  | <b>21.</b> \$8.88 by 8.8              |
| <b>10.</b> 8.498 by 1000 | <b>22.</b> \$6.46 by $8\frac{1}{2}$   |
| <b>11.</b> 647 by 0.001  | <b>23.</b> \$9.36 by $7\frac{1}{8}$   |
| <b>12.</b> 0.85 by 0.48  | <b>24.</b> \$8.12 by $17\frac{3}{4}$  |
- 25.** What will 24 thousand feet of pine timber cost at \$24.75 per thousand?
- 26.** What will 2.75 tons of coal cost at \$6.75 per ton?
- 27.** If a man travels 48.75 miles a day, how far will he travel in 6.75 days?
- 28.** Bought 7.75 yards of cloth for a suit of clothes, at \$3.37 $\frac{1}{2}$  a yard, and paid \$12.75 for making and trimming. What did the suit cost?
- 29.** What is 0.06 of 0.7 of 94.2?
- 30.** What will 18.625 bushels of corn cost at \$0.97 $\frac{1}{2}$  per bushel?
- 31.** If in one degree of latitude there are 69.16 miles, how many miles are there in  $42\frac{1}{2}$  degrees?
- 32.** Multiply 67 and 15 ten-thousandths by 18 thousandths.

DIVISION OF DECIMALS.**207. WRITTEN EXERCISES.**

- 1.**
- Divide 17.28 by 0.4.

$$\begin{array}{r} 4.) \overline{17\cancel{2}.8} \\ 43.2, \text{ Ans.} \end{array}$$

*Solution.* — Multiplying both dividend and divisor by the same number does not change the quotient. (Arts. 141 ; 153.)

Multiplying both dividend and divisor, then, by 10, by moving the point in each one place to the right, gives us an integer for the divisor. Dividing as in Art. 101, we have 43.2 for the quotient.

- 2.**
- Divide 0.7425 by 0.27.

$$\begin{array}{r} 2.75 \\ 27.) \overline{74.25} \end{array}$$

$$\begin{array}{r} 54 \\ \underline{202} \\ 189 \\ \underline{135} \\ 135 \end{array}$$

*Solution.* — Making the divisor an integer by moving both points two places to the right, we have  $74.25 \div 27$ . The quotient is 2.75.

**208.** To divide by a decimal, —

*Make the divisor an integer, by moving its decimal point to the right. Move the decimal point of the dividend an equal number of places to the right, annexing ciphers if necessary, and then divide. The point of the quotient will come directly under or over that of the dividend.*

**NOTE.** In U. S. money it is rarely necessary to extend the division farther than three decimal places. Give final results to the nearest cent. (Arts. 109 and 200, Notes.)

- 3.** Divide 8.64 by 0.16.      **4.** Divide 36.459 by 0.09.  
**5.** Divide 168 ten-thousandths by 8 hundredths.

**209. WRITTEN EXERCISES.**

Divide to three decimal places if the division does not terminate, —

- |                    |                         |
|--------------------|-------------------------|
| 1. 16.50 by 0.5    | 11. \$ 2.56 by 16       |
| 2. 2.88 by 0.18    | 12. \$ 64.96 by \$ 0.16 |
| 3. 29.25 by 25     | 13. 84.3 by 10          |
| 4. 292.5 by 2.5    | 14. 96.42 by 100 ×      |
| 5. 172.8 by 12     | 15. 80.5 by 2.3 ×       |
| 6. 17.28 by 1.2    | 16. 7.43 by 0.0079      |
| 7. 1.728 by 120    | 17. 16 by 24            |
| 8. 0.864 by 2.8    | 18. \$ 3 by \$ 0.15     |
| 9. 6.375 by 12.5   | 19. \$ 18.45 by \$ 0.30 |
| 10. 83.47 by 0.625 | 20. \$ 15.625 by \$ 250 |

21. Bought \$ 46.95 worth of cotton cloth at \$ 0.125 per yard. How many yards were there ?

22. Frank Smart earns 75 cents a day. How long will it take him to earn \$ 250 ?

23. At \$ 6.25 per barrel how many barrels of kerosene can be bought for \$ 156.25 ?

24. What is the price of butter when 75 pounds cost \$ 28.12½ ?

What is the price of one when

25. Six yards of cambric cost \$ 10.50 ?
26. 19 reams of paper cost \$ 64.125 ?
27. 0.75 of a pound cost \$ 0.625 ?
28. 17.25 acres of land are sold for \$ 560.625 ?
29. 17 weeks' board cost \$ 201.875 ?
30. 2435 square feet of land cost \$ 1521.875 ?
31. 2.8 tons of hay cost \$ 62.86 ?
32. 3.75 cords of wood cost \$ 18.30 ?

REVIEW.

210. ORAL EXERCISES.

1. How many cents in  $\$ \frac{3}{4}$ ? In  $\$ \frac{4}{5}$ ?
2. What is the fourth order of decimal units?
3. Change 0.14 to hundred-thousandths.
4. What common fraction is equal to 0.55?
5. What is the sum of  $\$ \frac{2}{3}$  and  $33\frac{1}{2}$  cents?
6. 35 is 0.7 of what number?
7. Multiply 4.83 by 100. By 1000.
8. When 100 pounds of butter cost \$28, what does one pound cost?
9. Divide 24.85 by 100. By 1000.
10. Change \$6 to cents. To mills.
11. In 1427 cents how many dollars?
12. If a painter receives  $\$ 0.16\frac{2}{3}$  per hour, how much does he earn in a day of 9 hours?
13. Four careless boys broke 6 panes of glass while snowballing. The glazier asked  $\$ 0.33\frac{1}{3}$  for setting each pane. What did each boy have to pay?
14. A fruit-dealer bought 3 dozen boxes of strawberries at  $\$ 0.08\frac{1}{2}$  a box, and sold the lot for \$3.75. What did he gain?
15. What will a dozen kitchen chairs cost at  $62\frac{1}{2}$  cents apiece?
16. I bought 24 palm-leaf fans at the rate of "6 for a quarter." What did they cost me?
17. Find the quotient of 1.6 divided by 0.8.
18. Multiply 0.08 by 0.09, and the product by 100.

**211. WRITTEN EXERCISES.**

1. Change 0.0625 to a common fraction.
2. In  $\frac{3}{80}$  how many ten-thousandths?
3. Add four hundred nine, and seventy-one thousandths; one thousand four ten-thousandths; one hundred, and one thousandth; two hundred two thousandths; eight thousand forty-six millionths; six, and forty hundredths.
4. Change to decimals and add  $\frac{3}{4}$ ,  $\frac{3}{8}$ ,  $\frac{5}{8}$ ,  $\frac{7}{10}$ .
5. Subtract two hundred ninety-seven thousandths from eight hundred twelve.
6. Divide 1.44 by 1.2 and subtract the quotient from their product.
7. By what must you multiply 5 to get 40? By what must you multiply 0.0144 to get 17.28?
8. Change the sum of 0.437 and 0.338 to a common fraction.
9. What is 0.75 of 842?
10. What is 0.064 of 6128?
11. \$125 is 0.25 of what sum?
12. Having 320 acres of land I sold  $\frac{3}{4}$  of it at one time and 0.10 of it at another. How many acres had I left?
13. Add \$4.67, \$2.84, \$6 $\frac{5}{8}$ , \$4 $\frac{3}{4}$  and \$7 $\frac{1}{2}$ .
14. The diameter of a circle is 300 feet. The circumference is 3.1416 times as long. How long is the circumference?
15. Find the cost of 180 geographies at \$0.83 $\frac{1}{2}$  each.

16. Bought a fore-quarter of spring lamb weighing 8 pounds at \$0.12 $\frac{3}{4}$ , and a hind-quarter weighing 10 pounds at \$0.16 $\frac{3}{4}$ . What was the amount of my bill?

17. Find the cost of 2 quarts of oysters at \$1.75 per gallon, and 7 $\frac{3}{4}$  pounds of halibut at 10 cents per pound.

18. What will 1 $\frac{1}{2}$  dozen bottles of cologne cost at \$0.50 a bottle?

19. If I spend \$106.68 for wheat at \$1.27 per bushel, how many bushels do I buy?

20. If 18 silver spoons cost \$24.75, what will 2 dozen cost?

21. My bill for 3 $\frac{1}{4}$  weeks' board at the "Seaside Hotel" was \$62.50. What was the price per day?

Find the cost of

22. 6 $\frac{1}{2}$  dozen hats at \$0.83 $\frac{1}{3}$  apiece.

23. 25 boxes of soap when 15 boxes cost \$26.25.

24. 2.75 acres of land when 1.25 acres cost \$65.

25. 75 pounds of sugar at 8 $\frac{3}{4}$  cents a pound.

26. 15 days' work when \$19.50 is paid for 12 days' work.

27. 7 $\frac{1}{2}$  yards of cloth at \$0.62 $\frac{1}{2}$  per yard.

28. 75 gross of crayons at \$0.10 $\frac{1}{2}$  per gross.

29. 7 hats at \$4.50 per dozen.

30. 60 lead pencils at \$3.50 per gross.

31. 11 handkerchiefs at \$7.89 per dozen.

32. 57 paper boxes at \$3.50 per hundred.

## MEASUREMENTS.

## LENGTHS.

**212. Linear or Length Measures** are those used in measuring lines and distances.

## TABLE.

12 inches (in.)	are 1 foot, ft.
3 feet	" 1 yard, yd.
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	" 1 rod, rd.
320 rods, or 5280 feet	" 1 mile, mi.

**213. ORAL EXERCISES.**

1. How would you give the length of this page? Of this room? Of the street on which you live?

2. How would you give the length of a river?

3. Name some articles that are sold by the yard.

4. Make a line 1 yard long on the blackboard. Divide it into thirds. How long is each third?

How many inches are there in

5.  $\frac{1}{2}$  ft. ?    7. 2 ft. ?    9. 5 ft. ?    11. 6 ft. ?    13. 1 yd. ?  
 6.  $1\frac{1}{2}$  ft. ?    8.  $2\frac{1}{4}$  ft. ?    10.  $\frac{3}{4}$  ft. ?    12.  $6\frac{2}{3}$  ft. ?    14.  $1\frac{1}{2}$  yd. ?

**214. A Compound Number** is a number composed of two or more denominations of the same general kind. Thus, 3 ft. 6 in. is a *compound number*.

How many inches in

15. 2 ft. 4 in. ?    17. 3 ft. 10 in. ?    19. 1 yd. 4 in. ?  
 16. 3 ft. 7 in. ?    18. 4 ft. 8 in. ?    20. 2 yd. 8 in. ?



**215. ORAL EXERCISES.**

How many feet are there in

1. 2 yd. ?    3.  $1\frac{1}{2}$  yd. ?    5.  $5\frac{1}{2}$  yd. ?    7. 2 yd. 2 ft. ?

2.  $\frac{2}{3}$  yd. ?    4. 1 rd. ?    6. 2 rd. ?    8. 1 rd. 6 ft. ?

9. How many yards in 12 ft. of rope ?    25 ft. ?

10. A piece of carpet is 5 ft. long and  $\frac{3}{4}$  yd. wide.

How many inches long and wide is it ?

11. How many rods in  $\frac{1}{2}$  a mile ?    In  $\frac{5}{8}$  of a mile ?

What part of a

What part of a

12. Foot in 8 in. ?

15. Mile in 32 rd. ?

13. Yard in 2 ft. ?

16. Mile in 40 rd. ?

14. Yard in 30 in. ?

17. Mile in 80 rd. ?

18. At \$1 a foot what will a rod of stone wall cost ?

19. What will 30 ft. of picture cord cost at 10 cents a yard ?

20. What will a mile of wire cost at a cent a foot ?

21. Find the distance in inches around the top of your desk.

22. How many rods of fence will enclose a garden 10 rods wide and 20 rods long ?

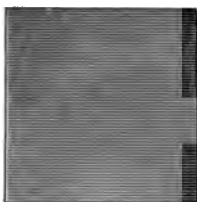
23. John's kite string was 100 yards long, but he lost 100 feet. How many feet had he left ?

24. A parlor is 18 feet wide. How many breadths of carpet a yard wide, will be needed for it ?

25. A street is 4 rods wide. How many feet across it ?

26. From a board 12 feet long a carpenter sawed a piece 2 ft. 6 in. long. How much remained ?

## SURFACES.



1 Square Inch.

**216.** A **Surface** has length and breadth only; as this page, or the outside of a box.

**17.** A **Square** is a flat surface having four equal straight sides and four equal corners or angles.

**218.** **Square or Surface Measures** are those used in measuring surfaces.

## TABLE.

( 144 square inches (sq. in.) are 1 square foot, sq. ft. )	
9 square feet	" 1 square yard, sq. yd.
30 $\frac{1}{2}$ square yards	" 1 square rod, sq. rd. )
( 160 square rods	" 1 acre, A. )

**219. ORAL EXERCISES.**

1. How long is a square foot? Draw one on the board. Divide it into square inches. How many are there?

2. Draw a square yard. How many feet long is it? How many square feet are there in it?

3. Imagine a square rod drawn on the ceiling of your school-room. How long would it be? How wide?

How many

4. Square feet are there in 5 square yards?

5. Square yards are there in 45 square feet?

6. Square feet are there in  $\frac{3}{4}$  of a square yard?

7. Square rods are there in  $\frac{1}{2}$  an acre?

**220.** A **Rectangle** is a flat surface having four straight sides and four equal angles.

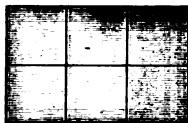
**221.** The **Area** of a rectangle is the surface included within its sides.



A Rectangle.

The area of a rectangle depends upon its dimensions; that is, upon its length and breadth.

Thus, a rectangle 3 inches long and 2 inches wide divided into square inches contains 2 rows of 3 square inches each, or  $2 \times 3$  square inches, or 6 square inches.



## 222. WRITTEN EXERCISES.

1. What is the area of a walk 25 feet long and 8 feet 6 inches wide?

$$8\frac{1}{2} \times 25 = 212\frac{1}{2}.$$

$$212\frac{1}{2} \text{ sq. ft., Ans.}$$

*Solution.* — A walk 25 ft. long and 1 ft. wide has an area of 25 sq. ft.; a walk 8 ft. 6 in., or  $8\frac{1}{2}$  ft., wide, must have an area of  $8\frac{1}{2}$  times 25 sq. ft., or  $212\frac{1}{2}$  sq. ft.

2. A rectangular walk has an area of  $212\frac{1}{2}$  square feet; its length is 25 feet. What is its width?

$$212.5 \div 25 = 8.5$$

$$8.5 \text{ ft.} = 8 \text{ ft. } 6 \text{ in.}$$

*Solution.* — As the area,  $212\frac{1}{2}$  sq. ft., is the product of the length and width of the walk, the width must equal the quotient of the area,  $212\frac{1}{2}$ , divided by the length, 25, or  $8\frac{1}{2}$  ft. = 8 ft. 6 in.

3. What is the area of a rectangle 20 inches long and 15 inches wide?

4. A rectangle 15 inches wide contains 300 square inches. How long is it?

**223.** To find the area of a rectangle,—

*Multiply its length by its breadth taken in the same denomination ; and*

*To find either dimension,—*

*Divide the area by the given dimension.*

5. How many square feet are there in the floor of a room 16 feet long and 12 feet wide ?

6. How many square inches are there in a yard of ribbon 3 inches wide ?

7. How many square yards of carpet will be needed for a room 18 feet long and 15 feet wide ?

8. If 30 square yards will carpet a room, how many yards must be bought if the carpet is  $\frac{3}{4}$  of a yard wide ?

9. How many square feet are there in the top of a table  $7\frac{1}{2}$  feet long and  $4\frac{1}{2}$  feet wide ?

10. A lot of land containing 5280 square feet is 40 feet wide. How long is it ?

11. A man concreted the sidewalk in front of his house at a cost of \$0.75 per square yard. The walk is 9 feet wide and 42 feet long. What did it cost him ?

12. A rectangular farm of 80 acres is 64 rods long. What is its width ?

13. My kitchen is 24 feet square. What will it cost to cover it with oil-cloth 8 feet wide, at \$1.25 a yard ?

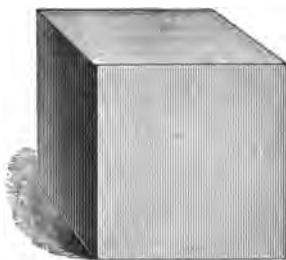
14. Mr. A's farm is 175 rods long and 84 rods wide. How many acres does it contain ?

15. Find the cost of carpeting a room 18 feet square with carpeting  $\frac{3}{4}$  yard wide, at \$1.60 a yard.

VOLUMES.

**224.** A **Solid**, or **Volume**, is anything that has length, breadth, and thickness; as this book or a box.

**225.** A **Cube** is a solid bounded by six squares. Its length, breadth, and thickness are equal.



1 Cubic Inch.

**226.** **Cubic Measures** are used in measuring solids or volumes.

**TABLE.**

1728 cubic inches (cu. in.)	are 1 cubic foot, cu. ft.
27 cubic feet	" 1 cubic yard, cu. yd.

1. What is the length of a cubic foot in inches? Its width?
2. What is the length, in feet, of a cubic yard? In inches? Its width in feet? Its thickness in inches?

**227. WRITTEN EXERCISES.**

1. In 5 cubic feet how many cubic inches?
2. In  $\frac{3}{4}$  of a cubic foot how many cubic inches?
3. How many cubic feet in 12 cubic yards?
4. How many cubic feet in  $\frac{2}{3}$  of a cubic yard?
5. How many cubic inches in a cubic yard?
6. How many cubic feet in 13824 cubic inches?
7. In 6561 cubic feet how many cubic yards?

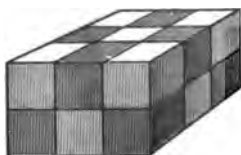


A Rectangular Volume.

**228.** A **rectangular Volume** is a body bounded by six rectangles.

**229.** The **Contents** of a rectangular volume are the space contained within its sides.

The contents of a rectangular volume depend upon its three dimensions, length, breadth, and thickness.



Thus, a rectangular volume 3 inches long, 3 inches wide, and 2 inches thick, contains in one layer 3 rows of 3 cubic inches each, or 9 cubic inches, and in 2 such layers, 2 times 9 cubic inches, or 18 cubic inches.

### 230. WRITTEN EXERCISES.

1. How many cubic feet are there in a block of marble 6 feet long, 4 feet wide, and 3 feet thick ?

$$6 \times 4 \times 3 = 72.$$

72 cu. ft., Ans.

*Solution.* — A block 6 ft. long, 1 ft. wide, and 1 ft. thick, contains 6 cu. ft. ; a block of the same length and thickness, 4 ft. wide, contains 4 times 6 cu. ft., or 24 cu. ft. ; if a block 6 ft. long, 4 ft. wide, and 1 ft. thick contains 24 cu. ft., a block of the same length and width 3 ft. thick will contain 3 times 24 cu. ft., or 72 cu. ft., Ans.

2. A box is 12 inches long, 12 inches wide, and 12 inches high. What are its contents in cubic feet ?

3. How many cubic feet will a trunk contain whose dimensions are 24 inches, 20 inches, and 15 inches ?

4. A block of marble 6 feet long and 4 feet wide contains 72 cubic feet. How thick is it?

$$6 \times 4 = 24.$$

$$72 \div 24 = 3.$$

3 ft., Ans.

*Solution.*—As the contents, 72 cu. ft., are the product of the three dimensions, the thickness must be the quotient of the contents, 72, divided by the product of the two given dimensions, 6 and 4, or  $72 \div 24$ , which equals 3. Ans., 3 ft.

**231.** To find the contents of a rectangular volume, —

*Find the product of its three dimensions taken in the same denomination; and*

*To find one of its dimensions, —*

*Divide the contents by the product of the two given dimensions.*

5. How many cubic feet of earth must be removed in digging a cellar 24 feet long, 20 feet wide, and 9 feet deep?

6. How many cubic inches are there in a cube 27 inches long?

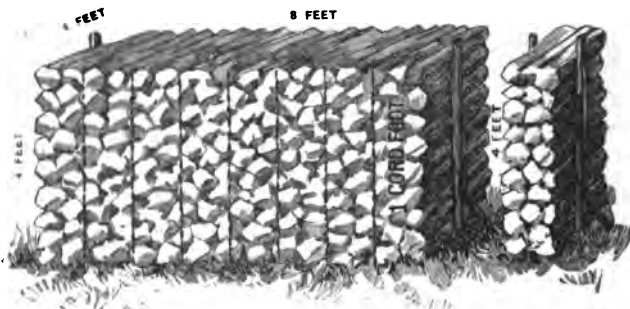
7. If your school-room is 30 feet square and 12 feet high, how many cubic feet of air does it contain?

8. A piece of ice containing 9120 cubic inches is 32 inches long and 30 inches wide. How thick is it?

9. If a cubic foot of granite weighs 165 pounds, what is the weight of a granite shaft 8 feet long,  $1\frac{1}{2}$  feet wide, and  $1\frac{1}{4}$  feet thick?

10. How many 2-inch cubes can be put into a box 3 feet long, 2 feet wide, and  $1\frac{1}{2}$  feet deep?

## WOOD MEASURE.



A CORD OF WOOD.

**232.** A Range of Wood 8 feet long, 4 feet wide, and 4 feet high, is a *cord*.

It contains  $8 \times 4 \times 4$ , or 128 cubic feet.

A *cord foot* is 1 foot in length of this range.

It contains  $4 \times 4 \times 1$ , or 16 cubic feet.

## TABLE.

16 cubic feet	are 1 cord foot, cd. ft.
8 cord feet or	} " 1 cord, cd.
128 cubic feet	

**233. WRITTEN EXERCISES.**

1. In 1536 cubic feet how many cords are there?
2. How many cubic feet in a range of wood 16 feet long, 8 feet high, and 4 feet wide? How many cords?
3. At \$5 a cord, what is the value of a range of wood 20 feet long, 8 feet wide, and 10 feet high?
4. A railroad company bought a range of wood 240 feet long, 12 feet high, and 4 feet wide at \$3.50 a cord. What did it cost?



## BOARD MEASURE.

**234.** A **Board Foot**, which is a square foot of board 1 inch thick, is the unit for measuring *lumber*, or *sawed timber*.

**235.** To find the contents of a board, plank, joist, &c., in board feet, —

*Multiply the product of the length and width, each taken in feet, by the thickness in inches.*

**NOTE.** Disregard the thickness, unless it is more than 1 inch.

**236. WRITTEN EXERCISES.**

1. Find the contents in board feet of a board 16 feet long,  $1\frac{1}{2}$  feet wide, and 1 inch thick.

2. A plank 2 inches thick is 14 feet long and 15 inches wide. How many board feet are there in it?

3. I bought 4 joists, each 16 feet long, 4 inches wide, and 3 inches thick, at 3 cents a board foot. What did they cost?

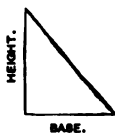
4. What will 1564 feet of pine lumber cost at \$30 per thousand?

**NOTE.** Multiply the price by the number of feet, and divide by 1000.

5. I bought 6 pieces of 8 by 10 timber (that is, 10 inches wide and 8 inches thick), each 18 feet long, at \$36 a thousand. What was the cost?

6. What is the cost of forty 3 by 4 joists 16 feet long at \$28 a thousand?

## MISCELLANEOUS MEASUREMENTS.



**237.** To find the area of a triangle, —

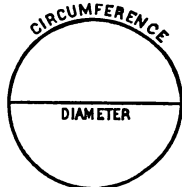
*Multiply its base by its height, and divide by 2.*

**238.** To find the circumference of a circle, —

*Multiply its diameter by  $3\frac{1}{7}$ .*

**239.** To find the diameter of a circle, —

*Divide its circumference by  $3\frac{1}{7}$ .*



**240.** To find the area of a circle, —

*Multiply its circumference by its diameter, and divide by 4.*

**241.** A **Perch** of masonry, or building stone, is 1 rod long,  $1\frac{1}{2}$  feet wide, and 1 foot thick, and contains  $24\frac{3}{4}$  cubic feet.

To find the number of perches in a piece of masonry, —

*Divide its contents in cubic feet by  $24\frac{3}{4}$ .*

**242.** To find the number of bushels a bin will hold, —

*Multiply its contents in cubic feet by 0.8.*

**243.** To find the number of gallons a tank will hold, —

*Multiply its contents in cubic feet by  $7\frac{1}{2}$ .*

**244. WRITTEN EXERCISES.**

1. What is the area of a triangle whose base is 24 inches and whose height is 16 inches ?

2. A triangle  $12\frac{1}{2}$  feet high measures 24 feet at its base. What is its area ?

3. What is the circumference of a wheel 5 feet in diameter ?

4. A stove-pipe measures 22 inches in circumference. What is its diameter ?

5. The dial of a clock is 14 inches in diameter. How many square inches are there in its area ?

6. At \$3 a perch what will it cost to lay a stone wall 55 feet long, 9 feet high, and 3 feet thick ?

7. Farmer Gray has built a bin 18 feet long, 6 feet wide, and  $4\frac{1}{2}$  feet deep. How many bushels of oats will it hold ?

8. Mr. Wood has a water tank in his attic 8 feet long, 5 feet wide, and 4 feet deep. How many gallons will it hold ?

9. Allowing 3 inches for welding, how long a piece of iron will be required to make a tire for a wagon wheel 5 feet in diameter ?

10. How many times will a wheel 7 feet in diameter revolve in going a mile ?

11. A bin 12 feet long,  $7\frac{1}{2}$  feet wide, and 5 feet deep, is half full of wheat. How many bushels are there ?

12. What is the area of a circle 12 feet in diameter ?

## DIFFERENCE BETWEEN DATES.

**245.** The names of the **Calendar Months**, and the number of days in each, are, —

1. January . . . . . 31	5. May . . . . . 31	9. September . . . 30
2. February . 28 or 29	6. June . . . . . 30	10. October . . . . 31
3. March . . . . . 31	7. July . . . . . 31	11. November . . . 30
4. April . . . . . 30	8. August . . . 31	12. December . . . 31

In a leap year February has 29 days. (Art. 116, Ex. 7.)

## WRITTEN EXERCISES.

**1.** James A. Garfield was born Nov. 19, 1831. What was his age when he became President, March 4, 1881?

*Solution.*

Nov. 19, 1831, to Nov. 19, 1880, 49 y.

Nov. 19, 1880, to Feb. 19, 1881,        3 mo.

Feb. 19, 1881, to Mar. 4, 1881,                13 d.

Nov. 19, 1831, to Mar. 4, 1881,    49 y. 3 mo. 13 d.

**246.** To find the difference between two dates, — .

*First find the number of entire years, then the number of entire calendar months, and then the remaining days.*

Find the number of years, months, and days, —

**2.** From Jan. 15, 1879, to Aug. 20, 1882.

**3.** From May 27, 1878, to Feb. 5, 1881.

**4.** From July 4, 1865, to Nov. 1, 1880.

**5.** From Aug. 17, 1877, to May 11, 1882.

**6.** From March 4, 1881, to Sept. 19, 1881.

**7.** From Dec. 25, 1880, to Oct. 11, 1882.

REVIEW.

**247. ORAL EXERCISES.**

1. How many feet are there in  $\frac{1}{2}$  a rod?
2. How many inches are there in  $\frac{3}{8}$  of a yard?
3. It is just a mile around a square field. How many rods are there in its length?
4. I bought a sheet of zinc 36 inches wide and 4 feet long at \$ 0.25 per square foot. What did it cost?
5. George is now 4 feet 10 inches tall. How much must he grow before he measures 6 feet?
6. How many 6-inch squares can you cut out of a square foot of paper?
7. If this page contains 28 square inches and is 7 inches long, how wide is it?
8. What will a cord of wood cost at \$ 0.50 a cord foot?
9. How many days are there from June 17th to July 4th?
10. Edward Green was born Feb. 29, 1876. How often can he celebrate his birthday? Why?
11. How many board feet in a board 10 feet long, 1 foot wide, and  $1\frac{1}{2}$  inches thick?
12. What is my board bill from June 10 to July 8, at \$ 8 per week?
13. If I pay \$ 2 a cord for sawing wood into 3 pieces, how much shall I pay for sawing it into 4 pieces?
14. A lady cuts a square yard of cloth into strips 3 inches wide. How many yards of strips has she?

15. If your trunk is 3 feet long, 2 feet wide, and 2 feet deep, how many cubic feet does it hold ?

16. If your house is 32 rods from the school-house, how many miles do you walk in a week in coming to school and going home ?

17. If you leave home July 20th and return August 19th, how many days are you away ?

18. A man sold  $\frac{1}{2}$  an acre of land at \$2 a square rod. What did he receive for it ?

19. Twenty make a score. How old is a gentleman who is threescore years and ten ?

20. Clara's flower-bed is 6 feet square ; Jennie's is 9 feet long and 4 feet wide. Which is the larger ?

21. How many square yards are there in the floor of a hall 10 feet long and  $4\frac{1}{2}$  feet wide ?

22. Which of the calendar months have 31 days each ?

23. My refrigerator is 3 feet long,  $2\frac{1}{2}$  feet wide, and 2 feet deep. How many cubic feet of ice does it contain when it is a third full ?

24. If a blackboard is 12 feet long and 3 feet wide, what will it cost to slate it at \$ $\frac{3}{4}$  per square yard ?

25. Flora's hoop is 3 feet in diameter. How far does it roll in each revolution ?

26. What will it cost to fence a lot of land 100 feet long and 50 feet wide, at \$0.25 a foot ?

27. If a rail is 2 rods long how many rails will be required to lay a mile of double railroad track ?

**248. WRITTEN EXERCISES.**

1. How many square feet are there in 3456 square inches?

2. How many cubic inches are there in  $2\frac{1}{2}$  cubic feet?

3. If a steel rail is 27 feet long, how many rails will be required to build a mile of railroad track?

4. How many square yards are there in an acre?

5. A cubic yard of earth is considered a load. How many loads of earth will be removed in digging a cellar 24 feet long, 15 feet wide, and 8 feet deep?

6. What is the cost of a range of wood a rod long, 4 feet wide, and 6 feet high, at \$6 a cord?

7. A car 30 feet long and 9 feet wide is filled with shelled corn to the depth of 4 feet. How many bushels are there?

8. If a cubic foot of marble weighs 165 pounds, what will be the weight of a shaft 4 feet long,  $1\frac{1}{2}$  feet wide, and 14 inches thick?

9. If a parlor 20 feet wide is to be carpeted with yard-wide carpeting, how many breadths will be required, and how much will have to be turned under?

10. How far does a 54-inch bicycle carry its rider at each revolution?

11. I bought 4 pieces of 8 by 10 timber, 24 feet long, for the sills of my house, at \$28 per thousand. What did they cost?

**12.** If a ton of hay occupies 500 cubic feet of space, how many tons are there in a mow 24 feet long, 20 feet wide, and 15 feet high?

**13.** A mason charged me \$3 a perch for a stone wall 50 feet long, 9 feet high, and  $2\frac{1}{2}$  feet thick. What did I pay him?

**14.** How many gallons are there in a reservoir 100 feet square if the water is 1 foot deep?

**15.** A barrel of flour weighs 196 pounds. What will a barrel and a half of flour cost at 6 cents a pound?

**16.** Washington was born Feb. 22, 1732, and died Dec. 14, 1799. How old was he when he died?

**17.** Allowing 60 pounds to make a bushel of potatoes, how many pounds of potatoes can be bought for \$8.60, at \$0.20 a peck?

**18.** If 1000 shingles will cover 100 square feet, how many will cover two sides of a roof each 30 feet long and 20 feet wide?

**19.** How many sheets of tin, each containing 2 square feet, will be required for a flat roof 24 feet by  $22\frac{1}{2}$  feet?

**20.** What will 2450 feet of lumber cost at \$36 per thousand?

**21.** A school-room 32 feet square and 15 feet high contains 50 pupils; how many cubic feet of space has each pupil?

**22.** If  $22\frac{1}{2}$  bricks will lay a cubic foot, how many bricks will be needed for a chimney 36 feet high and  $1\frac{1}{2}$  feet square,  $\frac{1}{3}$  of the space being allowed for the flue?



**23.** A street 4 rods wide contains 2 acres of land. How long is it ?

**24.** How many years were there from the death of President Lincoln, April 14, 1865, to that of President Garfield, Sept. 19, 1881 ?

**25.** How many square feet of ground will be covered by a circular tent 20 feet in diameter ?

**26.** A common brick is 8 inches long, 4 inches wide, and 2 inches thick. How many make a cubic foot ?

**27.** What will it cost to cement a cellar 36 feet long and 18 feet wide at \$ 1.25 per square yard ?

**28.** What will it cost to carpet a room 24 feet by 18 feet with carpet  $\frac{3}{4}$  of a yard wide, at \$ 1.50 per yard ?

**29.** What will it cost to fence a farm  $\frac{1}{4}$  of a mile square at \$ 0.75 a rod ?

**30.** At 30 cents a foot what will it cost to lay edge stones on both sides of a street 100 rods long ?

**31.** What is the value of a triangular piece of land whose base is  $7\frac{1}{2}$  rods and whose height is  $3\frac{1}{3}$  rods at \$ 4 an acre ?

#### QUESTIONS.

**212.** Give the table of length measures. **217.** What is a square ? **223.** How do you find the area of a rectangle ? **218.** Give the table of surface measures. **225.** What is a cube ? **226.** Describe a cubic yard. **231.** How do you find the contents of a rectangular solid ? **232.** Describe a cord of wood. **235.** How do you find the contents of a plank ? **238.** How do you find the circumference of a circle ? **240.** The area ?

## PERCENTAGE.

**249. Inductive Exercises.** — 1. What is  $\frac{1}{100}$  of \$ 100 ?  
 $\frac{8}{100}$  ?

2. What is  $\frac{1}{100}$  of 500 ? Of 600 ? Of 1200 ? Of 850 ?

3. What is  $\frac{5}{100}$  of \$ 300 ?  $\frac{6}{100}$  of \$ 800 ?  $\frac{10}{100}$  of \$ 600 ?

4. What is  $\frac{6}{100}$ , or 0.06, of 300 miles ?

5. 1 cent is what part of a dollar ? 3 cents ? 7 cents ?

6.  $\$ \frac{1}{2}$  is how many *hundredths* ?  $\$ \frac{1}{4}$  ?  $\$ \frac{3}{4}$  ?

7. How many *hundredths* are there in  $\frac{1}{4}$  ? In  $\frac{1}{5}$  ?  $\frac{2}{5}$  ?

8. In a school of 50 pupils 3 were absent. How many were absent out of a hundred ?

9. Out of a basket of 100 eggs 7 eggs were broken. What part was broken ?

**250. Per Cent** means *by the hundred*. Thus, 7 per cent means 7 of every hundred, or 7 *hundredths*.

**251.** The sign % is used for the words *per cent*. Thus, 3 % means 3 per cent, or 3 hundredths.

**252. Percentage** treats of computing in hundredths.

**253.** The **Rate**, or the *Rate per cent*, is the number of hundredths.

**254.** The **Percentage** of a number is the part of it denoted by the rate.

**255.** The **Base** is the number of which the part is taken.

**256.** The **Rate**, being a number of hundredths, is a *fraction*, and may be written as a decimal or as a common fraction. Thus,

$$\begin{array}{ll} 1\% = 0.01, \text{ or } \frac{1}{100} & 33\frac{1}{3}\% = 0.33\frac{1}{3}, \text{ or } \frac{33\frac{1}{3}}{100} \\ 5\% = 0.05, \text{ or } \frac{5}{100} & 125\% = 1.25, \text{ or } \frac{125}{100} \\ 25\% = 0.25, \text{ or } \frac{25}{100} & \frac{1}{2}\% = 0.00\frac{1}{2}, \text{ or } \frac{1}{100} \end{array}$$

### 257. WRITTEN EXERCISES.

Write as a decimal, as a common fraction, and as a common fraction in its smallest terms, —

- |                     |                       |                       |                       |                     |
|---------------------|-----------------------|-----------------------|-----------------------|---------------------|
| 1. 2%               | 8. $10\frac{1}{2}\%$  | 15. $33\frac{1}{3}\%$ | 22. $62\frac{1}{2}\%$ | 29. 125%            |
| 2. $2\frac{1}{2}\%$ | 9. $12\frac{1}{2}\%$  | 16. $37\frac{1}{2}\%$ | 23. $66\frac{2}{3}\%$ | 30. 150%            |
| 3. 4%               | 10. $16\frac{2}{3}\%$ | 17. 40%               | 24. 70%               | 31. 200%            |
| 4. 5%               | 11. $18\frac{3}{4}\%$ | 18. 48%               | 25. 75%               | 32. $\frac{1}{2}\%$ |
| 5. 6%               | 12. 20%               | 19. 50%               | 26. $83\frac{1}{3}\%$ | 33. $\frac{1}{4}\%$ |
| 6. $6\frac{1}{4}\%$ | 13. 25%               | 20. $56\frac{1}{4}\%$ | 27. 90%               | 34. $\frac{1}{8}\%$ |
| 7. $8\frac{1}{8}\%$ | 14. 30%               | 21. 60%               | 28. $91\frac{2}{3}\%$ | 35. $\frac{3}{8}\%$ |

**36.** What per cent of a number is  $\frac{1}{4}$  of it?

*Solution.* — Any number is 100% of itself;  $\frac{1}{4}$  of the number must be  $\frac{1}{4}$  of 100%, or 25% of the number.

**37.** What per cent of a number is  $\frac{1}{2}$  of it?

- |                    |                    |                    |                    |                      |
|--------------------|--------------------|--------------------|--------------------|----------------------|
| 38. $\frac{1}{3}$  | 45. $\frac{1}{20}$ | 52. $\frac{2}{25}$ | 59. $\frac{4}{5}$  | 66. $\frac{7}{12}$   |
| 39. $\frac{1}{5}$  | 46. $\frac{1}{25}$ | 53. $\frac{3}{4}$  | 60. $\frac{4}{25}$ | 67. $\frac{7}{25}$   |
| 40. $\frac{1}{6}$  | 47. $\frac{1}{30}$ | 54. $\frac{3}{5}$  | 61. $\frac{5}{6}$  | 68. $\frac{7}{20}$   |
| 41. $\frac{1}{8}$  | 48. $\frac{1}{40}$ | 55. $\frac{3}{8}$  | 62. $\frac{5}{8}$  | 69. $\frac{10}{206}$ |
| 42. $\frac{1}{10}$ | 49. $\frac{1}{50}$ | 56. $\frac{3}{10}$ | 63. $\frac{5}{12}$ | 70. $\frac{10}{300}$ |
| 43. $\frac{1}{12}$ | 50. $\frac{2}{3}$  | 57. $\frac{3}{20}$ | 64. $\frac{6}{25}$ | 71. $\frac{7}{800}$  |
| 44. $\frac{1}{16}$ | 51. $\frac{2}{5}$  | 58. $\frac{3}{50}$ | 65. $\frac{7}{8}$  | 72. $\frac{5}{4}$    |

**258. To find any Percentage of any Number.****ORAL EXERCISES.**

1. What is 60 % of \$ 25 ?

*Solution.* — 60 % of any number is  $\frac{3}{5}$  of it ;  $\frac{3}{5}$  of \$ 25 is \$ 15.

What is

- |                                    |                                      |
|------------------------------------|--------------------------------------|
| 2. 10 % of \$ 64 ?                 | 6. 60 % of \$ 45 ?                   |
| 3. 25 % of 36 pounds ?             | 7. $66\frac{2}{3}$ % of 42 gallons ? |
| 4. $33\frac{1}{3}$ % of 24 hours ? | 8. $62\frac{1}{2}$ % of 64 bushels ? |
| 5. $37\frac{1}{2}$ % of 320 rods ? | 9. 75 % of 6 months ?                |

10. I bought a watch for \$ 200, and sold it so as to gain 10 %. What was the selling price ?

11. A boy having \$ 45 in a savings-bank withdrew 40 % of it. How much remained ?

12. Charles spelled 80 % of his 50 words correctly. How many words did he miss ?

Find the gain or loss, and the selling price when

13. A watch costing \$ 150 is sold at a gain of  $33\frac{1}{3}$  %.
14. A horse costing \$ 200 is sold at a loss of 20 %.
15. Cloth costing \$ 1.20 is sold at a gain of  $16\frac{2}{3}$  %.
16. Boots costing \$ 4 are sold at a loss of  $37\frac{1}{2}$  %.
17. Coal costing \$ 4.50 is sold at a gain of 10 %.

How shall I mark goods that cost

- |   |  |
|---|--|
| 18. \$ 0.75 to gain 20 % ?                            | 23. \$ 0.30 to gain $66\frac{2}{3}$ % ?  |
| 19. \$ 2.00 to gain 40 % ?                            | 24. \$ 1.40 to gain 10 % ?               |
| 20. \$ 0.20 to gain 25 % ?                            | 25. \$ 0.62 $\frac{1}{2}$ to lose 20 % ? |
| 21. \$ 0.37 $\frac{1}{2}$ to gain $33\frac{1}{3}$ % ? | 26. \$ 1.60 to gain $12\frac{1}{2}$ % ?  |
| 22. \$ 24 to lose $8\frac{1}{3}$ % ?                  | 27. \$ 0.32 to gain $6\frac{1}{4}$ % ?   |

## WRITTEN EXERCISES.

1. What is 7% of \$448?

$\begin{array}{r} \$448 \\ 0.07 \\ \hline \$31.36 \end{array}$ 
*Solution.* — As  $7\% = 7$  hundredths, 7% of \$448 is 0.07 of \$448, or \$31.36. Hence,

**259.** To find any percentage of any number, —  
*Multiply the base by the rate per cent.*

What is

- |                  |                                    |
|------------------|------------------------------------|
| 2. 6% of \$845?  | 6. $3\frac{1}{2}\%$ of 218 yards?  |
| 3. 8% of \$947?  | 7. $9\frac{1}{4}\%$ of 848 pounds? |
| 4. 6% of \$857?  | 8. 37% of 91 miles?                |
| 5. 14% of \$476? | 9. 84% of 5280 feet?               |
10. A man who had \$2345 due him was able to collect only 45% of it. How much did he collect?
11. An agent sold \$4680 worth of goods at a commission of  $2\frac{1}{2}\%$ . What was his commission?
12. I insured my house for \$6400 for five years at  $1\frac{3}{8}\%$ . What did my insurance cost?

Find the gain or loss, and the selling price, when

13. A house costing \$8500 is sold at a gain of 25%.
14. A farm costing \$2840 is sold at a loss of 8%.
15. A store costing \$4860 is sold at a gain of 45%.
16. Cloth costing \$3.80 is sold at a gain of 15%.
17. Sugar costing \$0.08 is sold at a gain of 70%.
18. Potatoes costing \$0.64 are sold at a gain of 125%.
19. Hay costing \$16.85 is sold at a loss of 8%.
20. A watch costing \$350 is sold at a gain of  $28\frac{1}{2}\%$ .

**260. To find what per cent one Number is of another.**

**ORAL EXERCISES.**

1. 8 is what per cent. of 12 ?

*Solution.* — 8 is  $\frac{2}{3}$  of 12 ;  $\frac{2}{3} = \frac{2}{3}$ , and  $\frac{2}{3}$  is the same as  $66\frac{2}{3}$  hundredths, or  $66\frac{2}{3}\%$ .

2 to 25. Perform the Exercises on page 123, calling "what part" *what per cent*.

26. What per cent of 40 yards are 8 yards ?

27. If you pay \$8 for every \$100 borrowed, what rate do you pay ?

28. A boy bought a knife for \$0.30, and sold it for \$0.50. What per cent did he gain ?

29. Edward Giles, who weighed 80 pounds, gained 20 pounds in a month. What per cent did he gain ?

30. If you miss 8 words out of 25, what per cent do you spell correctly ?

31. Mr. Wilde bought a cow for \$50, and sold her for \$60. What per cent did he gain ?

What per cent of profit do I make when I buy for, —

32. \$4, and sell for \$6 ? 34. \$6, and sell for \$7 ?

33. \$3, and sell for \$4 ? 35. \$5, and sell for \$8 ?

36. What per cent of \$125 is \$64 ?

$$\begin{array}{r} .51\frac{1}{5} \\ 125 \overline{) 64.00} \end{array}$$

$$\begin{array}{r} 625 \\ \underline{150} \\ 125 \\ \underline{25} \\ 125 = \frac{1}{5} \end{array}$$

*Solution.* — \$64 is  $\frac{64}{125}$  of \$125. As  $\frac{64}{125} = 0.51\frac{1}{5}$ , \$64 is  $51\frac{1}{5}$  hundredths, or  $51\frac{1}{5}\%$  of \$125. (Art. 200.)

**261.** To find what per cent one number is of another, —

*Divide the percentage by the base, continuing the division to hundredths.*

## WRITTEN EXERCISES.

What per cent is

- |                                       |                         |
|---------------------------------------|-------------------------|
| 1. 4 of 25 ?                          | 8. \$4.20 of \$33.60 ?  |
| 2. 18 of 54 ?                         | 9. \$6.35 of \$44.45 ?  |
| 3. 9.6 of 48 ?                        | 10. \$8.96 of \$35.84 ? |
| 4. $4\frac{1}{2}$ of $9\frac{1}{2}$ ? | 11. \$6.48 of \$17.28 ? |
| 5. 16 of 25.6 ?                       | 12. \$3.36 of \$5.04 ?  |
| 6. $\frac{3}{4}$ of $\frac{7}{8}$ ?   | 13. \$4.50 of \$22.50 ? |
| 7. $3\frac{1}{2}$ of 10 ?             | 14. \$7.28 of \$58.24 ? |

15. A class missed 75 words in spelling 600. What per cent did they miss ?

16. A town five years ago had a population of 3450. It now has 3864. What has been the rate of increase ?

17. A flock of sheep was increased from 120 to 156. What was the per cent of increase ?

What per cent do I gain or lose by selling

18. A grand piano that cost \$625 for \$750 ?
19. Cotton cloth that cost \$0.12 $\frac{1}{2}$  a yard for \$0.16 $\frac{2}{3}$  ?
20. Saws that cost \$27 a dozen for \$2.50 each ?
21. A buggy costing \$180 for \$160 ?
22. A house for \$2640 for which I paid \$1716 ?
23. Books costing \$0.40 each for \$4.50 a dozen ?
24. Flour which cost \$7.50 a barrel for \$9.50 ?
25. Kerosene costing \$0.11 $\frac{1}{2}$  a gallon for \$0.09 $\frac{1}{2}$  ?

**262. To find a Number when a per cent of it is given****ORAL EXERCISES.***Review, Article 183, Page 122.*

1. I gained  $12\frac{1}{2}\%$  by selling a cow for \$10 more than I gave for her. What did she cost?

*Solution.* — \$10 is  $12\frac{1}{2}\%$ , or  $\frac{1}{8}$ , of the cost; the cost must be 8 times \$10, or \$80.

2. 12 is  $16\frac{2}{3}\%$  of what number?

Of what number is

3. 16,  $8\%$ ?      6. \$8,  $66\frac{2}{3}\%$ ?      9. \$30,  $75\%$ ?

4. 27,  $9\%$ ?      7. \$15,  $37\frac{1}{2}\%$ ?      10. \$21,  $33\frac{1}{3}\%$ ?

5. 28,  $10\%$ ?      8. \$9,  $60\%$ ?      11. \$15,  $7\frac{1}{2}\%$ ?

12. Mr. James sold a sewing-machine for \$50, and gained  $25\%$  by the operation. What did it cost?

*Solution.* — He gained  $25\%$ , or  $\frac{1}{4}$ , of the cost; hence he sold it for  $\frac{3}{4}$  of the cost +  $\frac{1}{4}$  of the cost, or  $\frac{4}{4}$  of the cost; as \$50 is  $\frac{4}{4}$  of the cost, the cost must be \$40.

Find the cost when

13.  $10\%$  is gained by selling butter at \$0.22 a pound.

14.  $12\frac{1}{2}\%$  is gained by selling tea at \$0.54 a pound.

15.  $20\%$  is gained by selling cloth at \$0.60 a yard.

16.  $30\%$  is gained by selling soap at \$0.26 a cake.

17.  $33\frac{1}{3}\%$  is gained by selling sugar at \$0.12 a pound.

18.  $37\frac{1}{2}\%$  is gained by selling paper at \$3.30 a ream.

19.  $50\%$  is gained by selling carpeting at \$1.50 a yard.

20.  $62\frac{1}{2}\%$  is gained by selling hats at \$13 per dozen.

21.  $100\%$  is gained by selling a painting for \$80.



**263. WRITTEN EXERCISES.**

1. \$71.75 is 25% of what number?

*Solution.*—As \$71.75 is 25% of some number, 1% of the number is  $\frac{1}{25}$  of \$71.75; 100% of the number is  $100 \times \frac{1}{25}$  of \$71.75 or \$287.

$$\frac{\$71.75 \times 100}{25} = \$287.$$

2. \$96 is 15% of what number?

Of what is

3. \$45.60, 16%?    6. \$360, 90%?    9. \$328.50, 75%?  
 4. \$28.80, 12%?    7. \$73, 20%?    10. \$800, 125%?  
 5. \$11.52, 18%?    8. \$476, 56%?    11. \$1080, 150%?  
 12. \$90 is 75% of the cost of my carriage. What did my carriage cost?  
 13. I gained \$1440 by selling my house at an advance of 36% on the cost. What did it cost?  
 14. I sold my horse for \$224, and gained 40% on the cost. What did it cost?  
 15. 20% of a ship's crew died of the scurvy, and 100 men remained. How many men were in the crew originally?

Find the cost when

16. 25% is gained by selling coal at \$8 per ton.  
 17. 30% is gained by selling hay at \$21.32 per ton.  
 18. 40% is lost by selling cloth at \$2.88 per yard.  
 19. 15% is gained by selling a house for \$5175.  
 20. 85% is gained by selling a farm for \$1665.  
 21. 100% is gained by selling a yacht for \$1800.

## INTEREST.

**264. Inductive Exercises.**—1. If 6% of the money borrowed is paid for its use 1 year, how much should be paid for the use of \$500? Of \$400? Of \$800? Of \$600?

2. What is paid for the use of \$500 for 1 year at 5%?

3. At 2%? 5. At 6%? 7. At 3%? 9. At 10%?

4. At 4%? 6. At 7%? 8. At 8%? 10. At 9%?

11. At 5% what is paid for use of \$600 for 1 year?

12. 2 years? 15.  $\frac{1}{2}$  of a year? 18.  $2\frac{1}{8}$  years?

13. 3 years? 16.  $\frac{1}{3}$  of a year? 19.  $3\frac{1}{2}$  years?

14. 4 years? 17.  $\frac{5}{8}$  of a year? 20.  $2\frac{3}{4}$  years?

21. At 10% what is paid for use of \$600 for 1 year?

22. 1 month? 25.  $\frac{1}{2}$  of a month? 28.  $\frac{1}{10}$  of a month?

23. 2 months? 26.  $\frac{1}{3}$  of a month? 29.  $\frac{3}{10}$  of a month?

24. 4 months? 27.  $\frac{5}{8}$  of a month? 30.  $1\frac{7}{10}$  months?

**265. Interest** is money paid for the use of money.

**266.** The **Principal** is the money for whose use interest is paid.

**267.** The **Rate** of interest is the number of hundredths of the principal paid for its use one year.

**268.** The **Amount** is the sum of principal and interest.

In computing interest, 12 months of 30 days each are a year.

**269. WRITTEN EXERCISES.**

1. What is the amount of \$586 for 3 y. 8 mo., at 4%?

$$\begin{array}{rcl}
 \$586 & = & \text{Principal.} \\
 .04 & = & \text{Rate.} \\
 \hline
 \$23.44 & = & \text{1 year's int.} \\
 3\frac{2}{3} & = & \text{Time in years.} \\
 3 \overline{) 4688} & & \\
 \underline{1562\frac{2}{3}} & & \\
 7032 & & \\
 \underline{\$85.94\frac{2}{3}} & = & \text{Required int.} \\
 586.00 & & \\
 \hline
 \$671.94\frac{2}{3} & = & \text{Amount.}
 \end{array}$$

*Solution.* — At 4% 1 year's interest is .04 of the principal, or \$23.44.  
 3 y. 8 mo. =  $3\frac{2}{3}$  years.  
 As 1 year's interest is \$23.44, the interest for  $3\frac{2}{3}$  years is  $3\frac{2}{3}$  times \$23.44, or \$85.94 $\frac{2}{3}$ . The amount is found by adding the principal, \$586, to the interest. The answer to the nearest cent is \$671.95.

- 270.** To compute interest at any rate, —

*Multiply the principal by the rate, and this product by the time in years.*

*To find the amount, add principal and interest.*

Find the interest

- |     | Of   | For         | At    |     | Of    | For        | At                 |
|-----|--|-------------|-------|-----|-------|------------|--------------------|
| 2.  | \$250  | 1 y. 6 mo.  | 5 %.  | 8.  | \$650 | 2 y. 4 mo. | 4 $\frac{1}{2}$ %. |
| 3.  | \$380  | 2 y. 3 mo.  | 6 %.  | 9.  | \$728 | 2 y. 2 mo. | 5 %.               |
| 4.  | \$450  | 3 y. 4 mo.  | 7 %.  | 10. | \$144 | 1 y. 5 mo. | 7 $\frac{1}{2}$ %. |
| 5.  | \$684  | 2 y. 9 mo.  | 8 %.  | 11. | \$693 | 1 y. 2 mo. | 8 %.               |
| 6.  | \$785  | 1 y. 10 mo. | 9 %.  | 12. | \$847 | 2 y. 3 mo. | 7 %.               |
| 7.  | \$696  | 8 mo.       | 10 %. | 13. | \$920 | 7 y. 3 mo. | 4 %.               |
| 14. | Find the amount of \$428 for 2 y. 10 mo. at 5 %. |             |       |     |       |            |                    |
| 15. | Find the amount of \$675 for 9 mo. at 8 %.       |             |       |     |       |            |                    |
| 16. | Find the amount of \$376.50 for 4 mo. at 4 %.    |             |       |     |       |            |                    |

**271. WRITTEN EXERCISES.**

1. Find the interest of \$654.75 for 3 mo. 17 d. at 6%.

$  \begin{array}{r}  \$654.75 = \text{Principal.} \\  107 = \text{Time in days.} \\  \hline  458325 \\  65475 \\  \hline  6 \overline{) 70.058 \overline{) 25}} \\  \hline  \$11.676+ = \text{Required int.}  \end{array}  $	<p><i>Solution.</i> — 3 mo. 17 d.          = 107 d. At 6% the interest for 1 year is <math>\frac{6}{100}</math> of the principal. The interest for 1 day, or <math>\frac{1}{360}</math> of a year, is <math>\frac{1}{360}</math> of <math>\frac{6}{100}</math>, or <math>\frac{1}{6000}</math> of the principal. The interest for 107 days</p>
--	--

is 107 times  $\frac{1}{6000}$  of the principal, or  $\frac{107}{6000}$  of the principal. To find  $\frac{107}{6000}$  of \$654.75, we multiply by 107 and divide by 6000. Dividing by 6000 is the same as dividing by 1000 and by 6. To divide by 1000 we move the decimal point 3 places to the left. (Art. 107.) Dividing by 6, we have \$11.68 interest to the nearest cent. Hence,

- 272.** To compute interest at 6%, —

*Multiply the principal by the time in days and divide by 6000.*

Find the interest at 6% of

- |  |  |
|--|--|
| <p>2. \$250 for 3 mo. 19 d.<br/>         3. \$378 for 2 mo. 20 d.<br/>         4. \$965 for 8 mo. 7 d.<br/>         5. \$842 for 3 mo. 3 d.<br/>         6. \$828 for 2 mo. 3 d.</p> | <p>7. \$846 for 1 y. 2 mo. 8 d.<br/>         8. \$258 for 1 y. 3 mo. 11 d.<br/>         9. \$893 for 10 mo. 29 d.<br/>         10. \$846 for 7 mo. 16 d.<br/>         11. \$912 for 118 d.</p> |
|--|--|
12. Find the amount of \$846.75 for 73 d. at 6%.  
 13. Find the amount of \$950 for 3 m. 21 d. at 6%.  
 14. Find the amount of \$721.84 for 68 d. at 6%.  
 15. Find the amount of \$648 for 1 y. 8 mo. 7 d. at 6%.

**273.** To find interest at any rate, —

*First find the interest at 6%, and then increase or diminish this interest by such part of itself as will give the interest at the required rate. Thus,*

Interest at 1% =  $\frac{1}{6}$  of 6% interest.

At 2% =  $\frac{1}{3}$  of 6%.

At 5% = 6% —  $\frac{1}{6}$  of 6%.

At 3% =  $\frac{1}{2}$  of 6%.

At 7% = 6% +  $\frac{1}{6}$  of 6%.

At 4% = 6% —  $\frac{1}{3}$  of 6%.

At 8% = 6% +  $\frac{1}{3}$  of 6%.

At  $4\frac{1}{2}$ % = 6% —  $\frac{1}{4}$  of 6%.

At 9% = 6% +  $\frac{1}{2}$  of 6%.

#### **274. WRITTEN EXERCISES.**

1. Find the interest of \$5184 for 2 mo. 20 d. at 7%.

\$5184 = Principal.

*Solution.* — 2 m. 20 d.

80 = Time in days.

= 80 days.

6 ) 414.720

6 ) \$69.12 = 6% int.

11.52 = 1% int.

\$80.64 = 7% int.

Multiplying by 80 and dividing by 6000, we find 6% interest to be \$69.12. This interest increased by  $\frac{1}{6}$  of itself is \$80.64, Ans.

Find the interest

2. Of \$1728 for 3 mo. 7 d. at 8%.
3. Of \$138.24 for 4 mo. 13 d. at 5%.
4. Of \$466.56 for 1 y. 2 mo. 20 d. at 7%.
5. Of \$740.88 for 2 y. 3 mo. 25 d. at 4%.
6. Of \$2304 for 7 mo. 25 d. at 3%.
7. Of \$2916 for 84 d. at  $4\frac{1}{2}$ %.
8. Of \$435.60 for 8 mo. 17 d. at 8%.
9. Of \$518.40 for 123 d. at 9%.

Find the amount

10. Of \$750 for 2 y. 8 mo. at 8%.
11. Of \$848 for 3 y. 6 mo. at 10%.
12. Of \$925.75 for 9 mo. 4 d. at 6%.
13. Of \$842.00 for 3 mo. 3 d. at 7%.
14. Of \$125.80 for 7 mo. 15 d. at 6%.
15. Of \$641.85 for 113 d. at 5%.
16. Of \$960 for 2 mo. 13 d. at  $4\frac{1}{2}\%$ .
17. Of \$211.25 for 1 y. 23 d. at 6%.
18. Of \$680.60 for 1 y. 2 mo. 2d. at 6%.
19. Of \$700 for 4 y. 6 mo. at 8%.
20. Of \$850 for 9 mo. 7d. at 3%.

Find the interest of

21. \$264 from Aug. 1, '82, to May 9, '83, at 5%.
22. \$180 from Sept. 2, '82, to Aug. 12, '83, at 7%.
23. \$366 from Oct. 9, '82, to May 4, '83, at 6%.
24. \$726 from Dec. 21, '82, to Aug. 19, '84, at 4%.
25. \$846.78 for 3 mo. 10 d. at  $4\frac{1}{2}\%$ .
26. \$976.25 for 1 y. 20 d. at 8%.

**275.** A **Promissory Note** is a written promise to pay absolutely a specified sum of money for value received.

The *Maker* of the note is the person who makes the promise, and the *Payee* is the one to whom the promise is made. The *Holder* is the owner of the note, the *Face* of the note is the sum named in it, and the *Indorser* is the one who writes his name on the back of the note as security for its payment.

# ROMAN NUMERALS.

**276.** The **Roman Numerals** are the seven letters, sometimes used in writing numbers. They are, —

I,	V,	X,	L,	C,	D,	M.
1,	5,	10,	50,	100,	500,	1000.

Other numbers are written by repeating or combining these letters. Thus, —

I = 1	XV = 15	CC = 200
II = 2	XVI = 16	CCC = 300
III = 3	XVII = 17	CCCC = 400
IV = 4	XVIII = 18	D = 500
V = 5	XIX = 19	DC = 600
VI = 6	XX = 20	DCC = 700
VII = 7	XXX = 30	DCCC = 800
VIII = 8	XL = 40	CM = 900
IX = 9	L = 50	M = 1,000
X = 10	LX = 60	MD = 1,500
XI = 11	LXX = 70	MM = 2,000
XII = 12	LXXX = 80	$\overline{X}$ = 10,000
XIII = 13	XC = 90	$\overline{C}$ = 100,000
XIV = 14	C = 100	$\overline{M}$ = 1,000,000

A dash (—) over a letter multiplies the value denoted by a thousand. Thus, —

$$\overline{M} = 1000 \times 1000 = 1,000,000.$$

**277. BUSINESS FORMS.****Receipt for Money on Account.**

\$ 200.

ALBANY, Aug. 12, 1882.

*Received from James Rice Two hundred Dollars on account.*

*John Adams.*

**Receipt in full of all Demands.**

\$ 60.

CHICAGO, Sept. 13, 1882.

*Received from John Bacon Sixty Dollars in full of all demands to date.*

*Charles Hill.*

**Order for Money.***Edward Reed & Co.,*

SYRACUSE, Sept. 25, 1882.

*Please pay Henry Howard, or order, Ten Dollars, and charge to our account.*

*R. S. Davis & Co.*

**Order for Goods.***Messrs. Wright & Son,*

NEW YORK, Oct. 1, 1882.

*Gentlemen: Please pay John Rowe, or order, Eighty Dollars in goods from your store and charge to the account of*

*E. F. Emerson.*

**Due-Bill for Merchandise.**

BOSTON, Dec. 7, 1882.

*Due, W. G. Ward, or order, Fifty-four  $\frac{75}{100}$  Dollars payable in goods from my store.*

*Samuel Rand.*



**Promissory Note on Demand.**

\$720.

BOSTON, March 19, 1895.

*On demand, I promise to pay J. S. Hayes, or order,  
Seven hundred twenty Dollars, with interest at 6%.*

*Value received.**Joseph Garland.***Promissory Note payable at a fixed Time.**

\$900.

PORTLAND, Dec. 7, 1882.

*One year after date I promise to pay S. C. Hunt, or  
order, Nine hundred Dollars, with interest at 5%.*

*Value received.**James F. Parsons.*

NOTE. — A note payable on demand is a *Demand Note*, and a  
note payable at a future specified time is a *Time Note*.

**Discountable Note.**

\$400.

MANCHESTER, NOV. 11, 1882.

*Four months after date I promise to pay to the order  
of Silas Dean, Four hundred Dollars, at the First  
National Bank. Value received.*

*Thomas Smith.***278. QUESTIONS.**

**250.** What is the meaning of per cent? **252.** Define percent-  
age. **253.** Rate. **255.** Base. **259.** How do you find any per-  
centage of any number? **261.** How do you find what per cent  
one number is of another?

**265.** What is interest? **266.** The principal? **267.** What is  
meant by the rate of interest? **268.** What is the amount?  
**272.** How do you compute interest at 6%? **273.** At any rate?  
**275.** What is a promissory note? **276.** What are the Roman  
Numerals?

## GENERAL REVIEW.

## 279. ORAL EXERCISES.

1. The smaller of two numbers is 17, and their difference is 9. What is the larger number?

2. From  $8\frac{1}{2}$  dozen eggs,  $7\frac{1}{2}$  dozen were taken. How many eggs remained?

3. How many feet are there in  $\frac{1}{2}$  a rod?

4. Name the factors of 96. Of 108. Of 144.

5. What is the greatest common divisor of 28 and 63?

6. How many weeks are there in 100 days?

Find the cost of

7. 15 oranges when 5 oranges cost \$0.12.

8. 9 yards of cloth when 7 yards cost \$28.

9. 12 pounds of sugar when 8 pounds cost \$1.

10.  $7\frac{1}{2}$  quarts of milk if 5 quarts cost \$0.40.

11. 27 lemons at \$0.36 a dozen.

12. 8 photographs at \$3 a dozen.

13. 7 dozen pencils at \$3.60 a gross.

14. If 7 plows can be bought for \$84, how many can be bought for \$96?

15. If \$60 will buy 8 dictionaries, how many will \$15 buy?

16. Sarah took music lessons for a year at \$16.50 per quarter. What did they cost her?

17. If 12 men can do a piece of work in 6 days, how many days will it take 9 men to do it?

18. If 7 men can build a wall in 8 days, how many days will 14 men require?

19. If a barrel of flour lasts 5 persons 10 months, how long will it last 8 persons?

20. How long will it take 5 men to hoe a field of corn if 6 men hoe it in 9 days?

21. I gave a grocer a two-dollar bill for 8 pounds of raisins at \$0.16 $\frac{2}{3}$  a pound. How much change did I receive?

22. How far will a ship sail in  $\frac{3}{8}$  of a day at the rate of 9 miles an hour?

23. Edward spent  $\frac{1}{4}$  of his money for a slate, and had 45 cents left. How much did he spend?

24.  $\frac{3}{4}$  of 36 is  $\frac{9}{10}$  of what number?

25. If you sleep  $\frac{1}{8}$  of the time, and study  $\frac{1}{4}$  of the time, how many hours a day have you left for other occupations?

26. What part of a square yard is there in a handkerchief  $\frac{1}{2}$  a yard square?

27. How many breadths of carpeting  $\frac{3}{4}$  of a yard wide will be needed for a hall 9 feet wide?

28. How high and long should a pile of 2-foot wood be to contain a cord?

29. What part of a 4-foot square is a 2-foot square?

30. At what hour of what day does the middle of October come?

31. How many days from Thanksgiving to Christmas when the former comes Nov. 28?

32. At \$ 0.33 $\frac{1}{2}$  a square foot, what will a square yard of zinc cost ?

33. What per cent does a grocer make by selling his goods at  $\frac{3}{4}$  of their cost ?

34. A lawyer collected \$ 800, and charged 5 % for his trouble. What was his fee ?

35. A clerk's expenses are 80 % of his salary, and he saves \$ 200 a year. What is his salary ?

36. Mr. Allen sold for \$ 200 a horse which cost him \$ 160. What per cent did he gain ?

37. I rent a house worth \$ 4000 for 10 % of its value per year, and take my pay in coal at \$ 8 per ton. How many tons do I have ?

38. How shall I mark goods that cost \$ 3 per yard so as to gain 12 $\frac{1}{2}$  % ?

39. A merchant deducted 5 % from a customer's bill for cash payment. If the sum deducted was \$ 20, what was the sum paid ?

40. What is the interest of \$ 400 for 2 y. 6 m. at 8 % ?

41. Henry Walker has \$ 500 in a savings bank that pays 4 % interest. How much money can he draw out at the end of 6 months ?

42. Two boys do a piece of work for \$ 6. If one does twice as much as the other, how ought the money to be divided ?

43. Two men bought a cord of wood. One paid \$ 3 and the other \$ 5. How many cord feet ought each to *have* ?

**280. WRITTEN EXERCISES.**

1. The divisor is 176, the quotient 175, and the remainder 174. What is the dividend ?

2. The product is 18769, and the multiplier 137. What is the multiplicand ?

3. The minuend, 46768, is 4 times the subtrahend. What is the remainder ?

4. The sum of divisor and quotient is 378. If they are equal numbers what is the dividend ?

5. Find the sum of the numbers in Exercises 1 to 5.

6. A and B together had \$655, but A having lost \$65, they then had equal sums. How much had B ?

7. A merchant bought 347 yards of cotton at 9 cents a yard, and 483 yards at 12 cents a yard. He paid \$37.50 cash, and gave a check for the balance. What was the value of the check ?

8. What was my gas bill for the quarter ending April 1, '82 ? I used 2 burners that consumed 4 cubic feet per hour, 3 hours each evening. The price was \$2.50 per thousand cubic feet.

9. If 5 tons of hay cost \$106.25 what will 13 tons cost ?

10. In what time will 48 men do a piece of work that 12 men can do in 24 days ?

11. How far can a man travel in 18 days at the rate of 378 miles in 6 days ?

12. If a locomotive runs 28 miles an hour, 12 hours a day for 312 days, how many miles does it run ?

Find the cost of

13. 100 tons of coal when 141 tons cost \$775.50.
14. 432 bushels of oats at \$0.57 $\frac{1}{2}$  per bushel.
15. 28 pounds of honey if 76 pounds cost \$14.06.
16. 100 days' labor at \$15 per week.
17. 7 months' rent at \$350 per year.
18. 13 quires of paper at \$4.20 per ream.
19. 10 inkstands at \$4.50 a dozen.
20. How many yards of cloth can be bought for \$1656.78 at \$3.18 per yard?
21. Change 364 $\frac{4}{5}$  and 581 to fifths.
22.  $\frac{2}{3}$  of Mr. A's property is in real estate,  $\frac{2}{3}$  of it is in railroad stock, and the remainder, \$16000, is in cash. What is Mr. A worth?
23. To what must you add the difference between 15 $\frac{3}{4}$  and 7 $\frac{7}{8}$  to make 12 $\frac{1}{2}$ ?
24. John Day sold Robert Burns 7 $\frac{3}{8}$  pounds of cheese at \$0.15, 15 pounds of beef at \$0.08 $\frac{3}{4}$ , and 2 quarts of syrup at \$0.75 a gallon. Make out a bill and receipt it.
25. A. G. Downs & Co. sold Miss Ida White 3 $\frac{1}{2}$  yards of gingham at 25 cents, 12 $\frac{1}{2}$  yards of muslin at 37 $\frac{1}{2}$  cents, and 2 $\frac{1}{2}$  dozen buttons at 50 cents. Make out and receipt her bill.
26. Add 1 $\frac{5}{8}$  and 0.0375.
27. Take 16 $\frac{2}{3} \times 144$  from  $\frac{5}{8}$  of 5000.
28. In how many hours will a pedestrian walk 100 miles at the rate of 4 $\frac{3}{4}$  miles per hour?

29. Divide the product of 0.48 and 0.09 by 0.016.
30. What will it cost to fence a rectangular field  $\frac{1}{4}$  of a mile long and 35 rods wide at \$ 0.75 a rod ?
31. A freight train consists of 80 cars. If the average length of a car is 33 ft., over what part of a mile does the train extend ?
32. A gardener sods a lawn 120 feet long and 90 feet wide for 8 cents a square yard. What does he receive ?
33. What will it cost to carpet a room 18 feet square with carpet  $\frac{3}{4}$  of a yard wide at \$ 1.75 per yard ?
34. What is the area of a circle 36 inches in diameter ?
35. How many rectangular blocks,  $1\frac{1}{2}$  feet wide and 2 feet long, will pave a cellar floor 15 feet wide and 16 feet long ?
36. A load of 4-foot wood is 6 feet long and  $4\frac{1}{2}$  feet high. What is it worth at \$ 5 a cord ?
37. What will be the cost of twenty-four 3 by 4 joists, 16 feet long, at \$ 30 per thousand ?
- Find the cost of
38. 19340 bricks at \$ 8 per thousand.
39. 42555 feet of boards at \$ 40 per thousand.
40. 4300 shingles at \$ 4.75 per thousand.
41. 1875 pounds of coal at \$ 6 per ton.
42. If  $\frac{7}{8}$  of a ship is worth \$ 35000, what is  $\frac{1}{2}$  of it worth ?
43. I received \$ 45 interest on a loan of \$ 900. What was the rate ?

44. A man bought a bill of goods amounting to \$168.75 and received a deduction of  $7\frac{1}{2}\%$  for cash payment. What did the goods cost him?

45. An agent received a commission of 5% on goods sold. If his commission was \$275, what was the amount of the sale?

What per cent is gained or lost when

46. A piano is bought for \$450, and sold for \$350?

47. A house is sold for \$6300, and bought for \$5600?

48. Cloth is bought at \$4.25, and sold for \$5.10?

49. What is the interest of \$846.75 for 1 y. 4 mo. 17 d. at 5%?

50. May 16, 1882, James Powers buys of George Gay a house for \$3500, and pays him by note due on demand, with 7% interest. Write the note, and find the amount due Jan. 7, 1883.

51. William French sells Murch & Co. 108 bushels of potatoes at \$0.37 $\frac{1}{2}$  a bushel, and receives \$25 cash and a due-bill for the balance. Write the due-bill.

52. Samuel Bond pays Mrs. T. G. Hume for 27 days board at \$6 a week. She gives him a receipt in full of all demands. Write the receipt.

53. Edward Shaw buys of David Gray 20 barrels of apples at \$2.25, and 80 pounds of maple sugar at 9 $\frac{1}{2}$  cents, and pays him with an order on Wm. French & Son. Write the order.

54. Find the proceeds of a note for \$256, having 72 days to run, discounted at 7%.







